DOCUMENT RESUME

ED 213 358 HE 014 854

AUTHOR	Broyles, Susan G.; And Others
TITLE	Foreign Participation in U.S. Science and Engineering Higher Education and Labor Markets. Special Report.
INSTITUTION	National Science Foundation, Washington, D.C. Div. of Science Resources Studies.
REPORT NO	NSF-81-316
PUB DATE	Sep 81
NOTE	76p.
AVAILABLE FROM	Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.
EDRS PRICE	MF01/PC04 Plus Postage.
DESCRIPTORS	Developing Nations; Doctoral Degrees; *Employment Patterns; *Engineering; *Enrollment Trends; *Foreign Students; Full Time Students; *Graduate Students; Higher Education; International Educational Exchange; Masters Degrees; Mathematics; Postdoctoral Education; Questionnaires; *Sciences

ABSTRACT

Information is presented on foreign graduate students, foreign science and engineering (S/E) students in master's-granting institutions. The impact of these foreign graduates in the U.S. labor force is also assessed. The data were obtained from the National Science Foundation-conducted graduate science students and postdoctorates survey of academic deans and department heads and the annual Survey of Earned Doctorates. Findings include the following: the foreign share of all full-time S/E graduate students in doctorate-granting institutions increased in almost all S/E fields between 1974 and 1979, but the growth was most dramatic in engineering and mathematical/computer sciences; in engineering, foreign citizens constituted almost one-half of the graduating doctorates; if present trends continue throughout the 1980s, as much as one-sixth of the 1990 U.S. doctorate engineering labor force might be foreign citizens; in the field of agricultural science, almost all foreign doctorate recipients hold temporary visas, which indicates foreign countries' interest in high-technology training; foreign citizens with temporary visas received at least 20 percent of the S/E doctorates awarded in 1979, largely the fields of engineering and physical, mathematical, and agricultural sciences; about one-half of the foreign S/E postdoctorates held positions in the life sciences; and over one-half of the foreign students receiving S/E doctorates in the 1970s were from the Middle East and Asia. Technical notes and questionnaires are appended. (SW)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED213358

foreign participation in U.S. science and engineering higher education and labor markets

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

National Science Foundation

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☐ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

THE ERIC FACILITY

national science foundation

special report
NSF 81-316

foreword

In the last decade the growing enrollment of foreign students at universities across the Nation has received increasing attention by academic and public policy officials. The number of foreign students doubled in the seventies as did that of U.S. citizens. The growth, however, has been more pronounced among science and engineering (S/E) disciplines. Thus one of every five students now enrolled full time in graduate programs is foreign. And in engineering, 4 of every 10 graduate students are foreign, as are almost 5 of every 10 engineering doctorate recipients.

The reasons for this foreign student growth are varied. The passage of the Fulbright Act of 1946 opened the door of U.S. education institutions to greater numbers of foreign students than previously permitted. During the subsequent 25 years, improved economic conditions in foreign countries produced a gradual increase in the number of foreign students financially able to study in the United States. Also, the recent decline in U.S. citizens seeking graduate-level degrees in science and engineering has prompted many U.S. institutions to initiate recruitment programs for foreign students to fill the growing number of empty desks in the classrooms. As the proportion of foreign students in higher education increased, issues have emerged concerning the relevancy of curriculums to foreign vs. U.S. needs, the financial burden of educating foreign students, and the potential impact on the U.S. labor market for scientists and engineers. The purposes of this report are to analyze the latest information on the influx of foreign students into U.S. S/E higher education and doctoral labor markets and to examine related problems and issues.

Charles E. Falk
Director, Division of Science
Resources Studies
Directorate for Scientific,
Technological, and
International Affairs

September 1981

notes

The resources from which statistics were selected for presentation in the three sections of this report are as follows:

Section	*Source*	*Date range of selected statistics*
1	Survey of Graduate Science Students and Postdoctorates (GSSP), National Science Foundation (NSF);	1974-79
	Annual Survey of Foreign Students, Institute of International Education (IIE); and	1954-79
	Fall Enrollment and Compliance Report of Institutions of Higher Education, National Center for Education Statistics (NCES), Department of Education	1954-79
2	Survey of Earned Doctorates, National Science Foundation (NSF);	1960-79
3	(Same sources as for section 1)	1977-79

Major emphasis in sections 1 and 3 was placed on data collected annually through the GSSP survey by NSF's Division of Science Resources Studies. Data on S/E doctorate recipients in section 2 are from the Survey of Earned Doctorates, an annual NSF-sponsored survey of doctorate recipients from U.S. universities.

References in sections 1 and 3 to "doctorate-granting institutions" are to be construed as including all institutional components with graduate S/E enrollment, such as branch campuses or schools of public health, nursing, and medicine.

Names of agencies, organizations, and programs are given in full the first time they are mentioned, followed by their acronyms in parentheses. Thereafter, only the acronyms are used throughout the publication, except in the tables and charts, which are sometimes reproduced separately from the text. Following is an alphabetical listing of all acronyms mentioned:

AID	—	Agency for International Development, Department of State
CGS	—	Council of Graduate Schools
FTE	—	Full-time-equivalent
GSSP	—	Survey of Graduate Science Students and Postdoctorates
IIE	—	Institute of International Education
NAFSA	—	National Association for Foreign Student Affairs
NCES	—	National Center for Education Statistics, Department of Education
NIH	—	National Institutes of Health, Department of Health and Human Resources
NRC	—	National Research Council
NSF	—	National Science Foundation
OPEC	—	Organization of Petroleum Exporting Countries
R&D	—	Research and development
S/E	—	Science and engineering
UN	—	United Nations

acknowledgments

This report was prepared by Susan G. Broyles and Nancy M. Conlon, Program Analysts in the Division of Science Resources Studies, and Penny D. Foster, Study Director, Universities and Nonprofit Institutions Studies Group. Supervision, review, and guidance were provided by: Alan Fechter, Head, Scientific and Technical Personnel Studies Section; William L. Stewart, Head, R&D Economic Studies Section; and Charles E. Falk, Director, Division of Science Resources Studies. Special thanks are in order to the staff of the Institute of International Education for providing NSF with data in advance of publication.

contents

	Page
Introduction	vii
Highlights	viii
Section:	
1. Foreign Graduate Students	1
Countries of Origin	1
Types of Institutions	2
Levels of Study	2
Issues Affecting Graduate Institutions	3
Issues Affecting Home Countries	4
Foreign Graduate S/E Students in Doctorate-Granting Institutions	4
Fields of Science and Engineering	5
Institutional Distribution	7
Geographic Distribution	8
Foreign S/E Students in Master's-Granting Institutions	10
Institutional and Geographic Distribution	10
Master's-level Departments	11
2. Foreign Recipients of U.S. S/E Doctoral Degrees	13
Long-Term Trends in S/E Doctorate Production	13
Total S/E Doctorate Production	13
Foreign-Citizen S/E Doctorate Recipients	15
Foreign-Citizen Participation in Total S/E Doctorate Production	16
Labor Market Implications	16
Implications for S/E Graduate Studies	17
3. Foreign S/E Postdoctorates in Doctorate-Granting Institutions	19
Fields of Science and Engineering	20
Institutional Distribution	22
Geographic Distribution	24
Appendixes:	
A. Technical Notes	26
B. Statistical Tables	28
C. Reproduction of Survey Instruments	56

introduction

Foreign participation in U.S. higher education increased in the seventies when enrollment of foreign students doubled at both the undergraduate and graduate levels. In addition to growth in numbers, foreign full-time graduate students increased their share of enrollment in S/E fields both in doctorate-granting universities and in universities that grant only master's degrees.

The growth of foreign students in U.S. S/E graduate schools has implication not only for graduate training, but can also have an impact on the domestic S/E labor force. To the extent that these foreign students return to their countries of origin, their participation may be viewed as an indicator of foreign demand for U.S. graduate training in science and engineering; alternatively, to the extent that they remain here they contribute to the domestic supply of S/E skills. Furthermore, since the payments required by foreign students may not cover the full costs of graduate training, foreign student support may represent an unintended but significant subsidy by U.S. taxpayers.

The major objective of this study is to provide facts that illuminate issues for which evidence heretofore has been largely anecdotal. Section 1 of this report covers graduate student enrollment and is based primarily on the data derived from the NSF-conducted graduate science students and postdoctorates (GSSP) survey of academic deans and department heads. The material provides an overview of foreign student involvement throughout higher education and more detailed analysis of S/E graduate enrollment.

Section 2, focusing on S/E doctorate production, is drawn from the annual Survey of Earned Doctorates, a survey of newly-graduated Ph.D.'s in science and engineering sponsored jointly by NSF, the Department of Education, the National Institutes of Health (NIH), and the National Endowment for the Humanities (NEH) and conducted by the National Research Council (NRC). This section provides an analysis of S/E doctorates earned by foreign citizens at universities in the United States. It also discusses the impact of these foreign doctorates on the domestic labor force. Finally, it examines foreign S/E doctorates with temporary visas as an indicator of the foreign demand for graduate S/E training at the doctorate level.

The data presented in section 2 classify new S/E doctorates by detailed S/E field of degree, whereas the data presented in sections 1 and 3 classify S/E graduate students by academic department. Academic departments frequently offer doctorate-level programs in more than one field and the department in which a particular program is offered may vary by institution. Consequently, special care should be taken when attempting comparisons of data on fields of science or engineering presented in section 2 with those shown in sections 1 and 3.

Section 3 covers postdoctorate appointments in U.S. doctorate-granting institutions and is drawn primarily from the GSSP survey. It documents the participation of foreign citizens in S/E postdoctorate programs and examines the institutional and geographic distribution of academically employed foreign postdoctorates.

highlights

- Foreign participation in higher education in the United States became increasingly pronounced during the seventies, especially at the graduate school level. Underlying this trend are two major factors: increased demand for U.S. training to meet foreign needs for skilled S/E workers; and increased recruitment by U.S. institutions to augment domestic enrollment, which has been growing less rapidly in recent years and which is expected to decrease as a result of projected age-specific population declines.

Graduate Training

- Enrollment of foreign students doubled during the seventies at both the undergraduate and the graduate levels, to almost 290,000 in 1979. Proportionately, foreign enrollment at the undergraduate level remained relatively stable at around 2 percent; at the graduate level it oscillated between 7 percent and 9 percent, reaching a peak of 12 percent in 1974.

- The proportion of foreign full-time graduate students in S/E fields rose from 16 percent in 1974 to 20 percent in 1979. Their share of the 1979 graduate enrollment total in S/E fields was twice that of their graduate enrollment in all fields.

- The foreign share of all full-time S/E graduate students in doctorate-granting institutions increased in almost all S/E fields between 1974 and 1979, but the growth was most dramatic in engineering and mathematical/computer sciences. Over 40 percent (16,200) of the 1979 graduate enrollment in engineering and over 30 percent (4,300) of the enrollment in mathematical/computer sciences consisted of foreign students.

Doctorate Production

- About 3,600, or one of every five S/E doctorates granted by U.S. universities was awarded to foreign citizens in 1979. In engineering alone, foreign citizens constituted about 1,200, or almost one-half of the graduating doctorates.

- The number of foreign citizens granted S/E doctorates more than quadrupled from 1960 to 1974 and then fell by 14 percent from 1974 to 1979. These trends roughly parallel those in S/E doctorates granted to U.S. citizens. The recent decrease reflects probable earlier declines (i.e., in the late sixties and early seventies) in foreign student graduate school S/E enrollments.

- The share of all S/E doctorates awarded to foreign citizens increased steadily from about 15 percent in 1960 to 23 percent in 1974 and since then has remained relatively stable.

- The short-term impact of foreign citizens on the domestic S/E doctorate labor supply is trivial—less than 1 percent. The long-run impact, however, could be significant in some fields if trends continue. About 1 of every 10 foreign citizens awarded S/E doctorates in 1979 planned to remain in the United States. In engineering almost one of every three Ph.D. recipients had such plans. If these patterns were to continue throughout the eighties as much as one-sixth of the 1990 U.S. doctorate engineering labor force might be foreign citizens. In 1979 roughly 12 percent of all engineering doctorates in the United States were foreign citizens.

- The prevalence of foreign citizens in domestic doctorate production can indicate foreign interest in high technology training in U.S. institutions. The field of agricultural science where almost all foreign doctorate recipients hold temporary visas seems to typify this interest. Foreign participation has been substantial (over 30 percent in the seventies) and growing, but relatively few of these doctorate holders have remained in this country upon completing their degrees.

- Foreign citizens with temporary visas—an indicator of foreign countries' interest in high-technology training—received at least 20 percent of the S/E doctorates awarded in 1979 in each of more than 40 subspecialties—largely in the fields of engineering and physical, mathematical, and agricultural sciences. The largest shares were in fuel technology/petroleum engineering (67 percent) and in agricultural engineering (59 percent).

- Over one-half the foreign students receiving S/E doctorates in the seventies were from the Middle East and Asia.

Postdoctorates

- Foreigners constituted about one-third (almost 6,500) of the S/E postdoctorates employed in doctorate-granting institutions in 1979—down from almost one-half in 1967. Two of every three engineering postdoctorates were foreigners in 1979, whereas the ratio in the physical sciences was only 1 of 10.

- About one-half of the foreign S/E postdoctorates held positions in the life sciences. This reflects both the interests of their countries and the dominant role of the life sciences in the utilization of postdoctorates. (Over 70 percent of U.S. citizens with S/E postdoctorates also were in the life sciences.) An additional one-third of the foreign S/E postdoctorates were employed in the physical sciences.

section 1

foreign graduate students

This following description of foreign participation in U.S. graduate education in all fields of study provides background for analyses of foreign student enrollment in S/E disciplines. When foreign enrollment doubled in U.S. institutions of higher education during the seventies (table 1), the impact was felt in all fields and at all levels of study. The Fulbright Act in 1946 supported an expanded international educational exchange and provided the impetus for this influx of foreign students into the United States. During the 1954-79 period, the number increased more than eightfold (table B-1).[1] by 1979, foreign students constituted 2.4 percent of the 11.7 million students enrolled.

Foreign participation in graduate S/E programs on a full-time basis rose 41 percent between 1974 and 1979, whereas the number of U.S. citizens enrolled full time rose only 9 percent. The real impact of these disparate rates of growth becomes evident only at the individual field level. For example, in 1979 foreign students enrolled full time in engineering programs comprised two-fifths of the total number of full-time students in this field and nearly one-third of those in the mathematical/computer sciences field.

Table 1. Foreign enrollment in U.S. institutions of higher education for selected years

Selected years	All institutions		
	Total enrollment	Foreign enrollment	Foreign as a percent of total
1954	2,499,800	34,200	1.4
1964	5,320,000	82,000	1.5
1970	8,649,400	144,700	1.7
1975	11,290,700	179,300	1.6
1976	11,121,400	203,100	1.8
1977	11,415,000	235,500	2.1
1978	11,392,000	263,900	2.3
1979	11,707,100	[1] 286,300	[1] 2.4

[1] Preliminary
SOURCES: National Center for Education Statistics and Institute of International Education

countries of origin

In 1979, over one-third of the foreign students in U.S. institutions were from 4 nations: Iran, Taiwan, Nigeria, and Canada (table 2). Iran alone provided nearly 18 percent and over one-half of the total came from only 10 nations. The number of students from the Organization of Petroleum Exporting Countries (OPEC) increased from 9 percent in 1954 to 35 percent in 1979 (table B-2).

Most of the third-world countries are presently unable to accommodate the tremendous number of students now seeking postsecondary education in their own institutions. These countries lack the personnel, facilities, and equipment required to provide their students with the quality of education available in the United States. In fact, it was shown in a 1978 United Nations (UN)-sponsored survey of professional personnel that academic benefits such as advanced curriculums and facilities were the reasons most often given by students for studying abroad. Other motivating factors included the following: (1) value of academic experience after return to the home country; (2) opportunity to find work abroad; (3) escape from controls at home; (4) beneficial influence of family and friends abroad; (5) academic encouragement from the home country; and (6) prospects for permanent emigration.[2]

[1] Institute of International Education (IIE), *Open Doors: 1978/79* (New York, N.Y., 1980), table 1.0, p. 1, and preliminary data for 1979/80.

[2] William A. Glaser, *The Brain Drain: Emigration and Return*, Summary of Findings, Pergamon Press, 1978, p. 177.

Table 2. Ten leading countries of origin in foreign enrollment in U.S. institutions of higher education: 1954, 1974, and 1979

1954 Country by rank	Foreign enrollment	Percent distribution
Total, all countries	34,230	100
Leading 10 countries, total	17,550	51
1 Canada	4,660	14
2 Taiwan	2,550	7
3 India	1,670	5
4 Japan	1,570	5
5 Philippines	1,480	4
6 Colombia	1,300	4
7 Mexico	1,250	4
8 Korea, Republic of	1,200	3
9 Iran	1,000	3
10 Venezuela	880	2
All other countries	16,680	49

1974 Country by rank	Foreign enrollment	Percent distribution
Total, all countries	154,580	100
Leading 10 countries, total	79,960	52
1 Iran	13,780	9
2 Hong Kong	11,060	7
3 Taiwan	10,250	7
4 India	9,660	6
5 Canada	8,430	5
6 Nigeria	7,210	5
7 Thailand	6,250	4
8 Japan	5,930	4
9 Mexico	4,000	3
10 Korea, Republic of	3,390	2
All other countries	74,620	48

1979 Country by rank	Foreign enrollment	Percent distribution
Total, all countries	286,300	100
Leading 10 countries, total	157,180	55
1 Iran	51,310	18
2 Taiwan	17,560	6
3 Nigeria	16,360	6
4 Canada	15,130	5
5 Japan	12,260	4
6 Hong Kong	9,900	4
7 Venezuela	9,860	3
8 Saudi Arabia	9,540	3
9 India	8,760	3
10 Thailand	6,500	2
All other countries	129,120	45

SOURCE: Institute of International Education

types of institutions

Most foreign students coming to the United States enroll at the major research universities, since these institutions are well known internationally for their high academic standards. Until recently, these institutions usually had been among those classified as "Research Universities I and II" (codes 1.1 and 1.2) by the Carnegie Council on Policy Studies in Higher Education (table B-6 and B-7). In 1954, the 10 institutions with the largest enrollment of foreign students were all in the Research Universities I category and attracted 21 percent of the total foreign student population. By 1979, however, only 7 percent of leading 10 in foreign enrollment held this classification (see appendix A, technical notes, for the selection criteria). The 10 leaders together enrolled just 8 percent of the 1979 foreign student total, indicating a gradual dispersion of foreign students into other types of institutions (table 3). Of the 10 leading institutions in 1979, the highest percentage of foreigners was enrolled at Texas Southern University.

levels of study

The balance between graduate and undergraduate training of foreign students has fluctuated somewhat since

Table 3. Ten leading U.S. institutions in foreign enrollment: 1979

Carnegie code	Rank	Institution	All institutions of higher education: Total enrollment	Foreign enrollment	Foreign as percent of total
		Total, all U.S. institutions	11,707,100	286,300	2
		Total, leading 10 institutions	301,138	23,891	8
1.1	1	University of Southern California	26,902	3,305	12
4.0	2	Los Angeles City College	18,407	3,000	16
4.0	3	Miami-Dade Community College	39,212	2,790	7
2.1	4	Texas Southern University	8,528	2,585	30
1.1	5	University of Texas, Austin	44,102	2,354	5
1.1	6	University of Wisconsin, Madison	40,203	2,092	5
1.1	7	Columbia University, Main	17,119	2,037	12
1.1	8	University of Michigan, Ann Arbor	36,158	1,941	5
1.1	9	University of California, Los Angeles	32,980	1,907	6
1.1	10	University of Washington	37,547	1,880	5
		All other institutions	11,405,962	262,409	2

[1] See technical notes for selection criteria.

SOURCES: National Center for Education Statistics and Institute of International Education

Table 4. Foreign enrollment in U.S. institutions of higher education by level of study for selected years

Level	1954	1964	1969	1975	1978	1979[1]
	Percent distribution					
Total	100	100	100	100	100	100
Undergraduate	61	52	52	54	57	65
Graduate	39	48	48	46	43	35

[1] Preliminary.

SOURCE: Institute of International Education

the midfifties, when the IIE survey series began. According to the data published by IIE, the proportion of foreigners enrolled for graduate study increased gradually from 39 percent of the foreign student population in 1954 to the 48-percent peak in 1969, but declined to 35 percent in 1979 (table 4). This declining emphasis on grduate programs by foreign students in the late seventies is consistent with that of the total student population. Only 9 percent of all students in U.S. institutions of higher education were enrolled for graduate study in 1979 according to NCES, down from 12 percent in 1974 (table 5).[3] In recent years there appears to be a movement toward acquisition of the type of practical skills available through associate degrees from technical institutions and 2-year community colleges. A 79-percent increase in foreigners enrolled for associate and 2-year degrees in the United States was reported by IIE between 1976 and 1979, and the share represented by these students rose also, from 10 percent to 13 percent of the foreign-student total.[4]

Table 5. Total enrollment in U.S. institutions of higher education by level of study: 1974-79

Level	1974	1975	1976	1977	1978	1979
	Percent distribution					
Total	100	100	100	100	100	100
Undergraduate and unclassified	86	87	88	88	88	89
First professional	2	2	2	2	2	2
Graduate	12	11	10	10	10	9

SOURCE: National Center for Education Statistics

issues affecting graduate institutions

A major issue arising from the expanding proportion of foreign graduate students in U.S. institutions is that of the relevancy of graduate programs to foreign students' needs and expectations. In an attempt to assess the extent to which institutions were making adjustments in curriculums on behalf of foreign graduate students from developing countries, a survey of faculty in 93 graduate institutions was conducted in 1978. It was sponsored by the Agency for International Development (AID), with the cooperation of the Council of Graduate Schools (CGS) and the National Association for Foreign Student Affairs (NAFSA). Among the major findings, NAFSA concluded that "... There were major difficulties seen by U.S. faculty in the transfer by their students from developing countries of knowledge gained here to professional work back home: The lack of adequate equipment and technical facilities; cultural differences; resistance on the part of the older generation of administrators to the ideas of U.S. trained professionals who have recently returned; and problems in translating theoretical knowledge into practical application in environments not conducive to new application of knowledge."[5] As expected, these problems did not apply equally to each field studied. Engineering faculty rated inadequate equipment as of prime importance to foreigners on their return home, as did faculty in the physical sciences. In the social sciences, cultural differences and a nonconducive environment were cited most often as primary difficulties for returning foreigners. Changes in course content in response to foreign students' needs were made by only about one-third of the surveyed faculty, and these were primarily in the social sciences.[6]

As growth in the enrollment of U.S. citizens showed signs of diminishing, some institutions have turned to foreign students in an attempt to prevent decreases in total enrollment. The recruiting efforts and admissions criteria of such institutions have come under scrutiny in recent years. A NAFSA task force in the early seventies examined a series of issues regarding the education of foreign graduate students by surveying 24 departments in 6 disciplines. Regarding admissions policies, the 1972 study found that decisions were usually made by chairmen or directors of graduate studies; the faculty were seldom involved in the process. Deans' offices rarely exerted any decisive influence other than assuring conformity to minimum requirements. Departmental decisions were more often based on availability of adequate financial support and the ratio of foreign to U.S. students. The study also found that:

> In a few universities, some departments admit a disproportionate number of well qualified foreign students as a means of maintaining the size of the department without sacrificing its quality. However, most departments do not admit foreign students in order to avoid admitting some academically less qualified U.S. students.[7]

Several years later this tendency to "over-admit" was also found to exist in State-supported institutions. In 1975, CGS held a workshop in which foreign student selection procedures were discussed. One of the conclusions drawn was that:

> One suspects at times that some departments in some State-supported institutions actually use the backlog of foreign applicants to top off the tank of graduate admissions in order to meet 'full-time-equivalent' student enrollment goals, which in turn,

[3] National Center for Education Statistics (NCES), Opening Fall Enrollment, annual series.

[4] IIE, *op. cit.*, table 3.6, p. 25, and preliminary data for 1979/80.

[5] National Association for Foreign Student Affairs (NAFSA), *The Relevance of U.S. Graduate Programs to Foreign Students from Developing Countries*, (Washington, D.C., April 1979), p. 10.

[6] *Ibid.*, table 3, p. 14.

[7] NAFSA, *An Inquiry Into Departmental Policies and Practices in Relation to the Graduate Education of Foreign Students*, (Washington, D.C., April 1972), p. 12.

justify continuation of financial support for expensive doctoral progams.[8]

At another CGS workshop, held in 1978, the panelists cautioned the membership that there continued to be a serious problem of "recruiting and headhunting," and that " . . . the challenge to you and your institutions is to be responsive to the educational needs of countries, but to be responsive in a way that your action is responsible for the long-term needs of the students *and* the countries, and that the standards by which you are responsive are of the highest order."[9]

Any future rise in the proportion of foreign students within the total student population undoubtedly will intensify the search for better ways to determine and defray the real costs of educating these students and the future role of public financing in their acquisition of technical skills. In just a few short years, from 1976 to 1979, the percentage of all foreign students in U.S. institutions of higher education that relied on their own or their governments' resources for financial assistance rose from 74 percent to 81 percent.[10] Unfortunately, the extent of the U.S. public's financial aid to foreign students at the graduate level, and particularly S/E programs, cannot be ascertained for a comparable period.

issues affecting home countries

Adequacy and relevancy of training received in the United States by foreign students are topics of concern among developing countries in particular; the positive aspects of educating their students abroad are often counterbalanced by certain negative features. One study of the Middle Eastern countries in particular found the following drawbacks in sending their students to U.S. institutions: " . . . inappropriate training for home country needs; heavy costs in terms of time and resources; specializations especially at the dissertation level, that reflect the interest of the host country rather than those of the Middle Eastern state; and the brain drain."[11] This last issue, the matter of the draining off of scientific and technological skills, is particularly acute for developing countries attempting to achieve social and economic goals. A 1978 UN-sponsored survey of professional personnel who studied abroad found that " . . . a country will lose more of its citizens who study abroad if it educates more persons than the economy can absorb, and if the foreign-trained feel their prospects are insecure after return. Improved manpower planning and closer coordination between educational and economic sectors can improve the balance."[12]

foreign graduate s/e students in doctorate-granting institutions

Data from the GSSP survey show that (1) the growth in the number of foreign full-time graduate S/E students outpaced that of their domestic counterparts during the latter part of the seventies, and (2) that by 1979, foreign students represented 20 percent of all full-time students in graduate S/E programs in the United States, up from a 16-percent share in 1974 (charts 1 and 2).

By fall 1979, nearly 45,000 foreign graduate students were enrolled full time in our Nation's doctorate institutions in programs leading to an advanced degree in an S/E field (table B-3.) This figure represents a 41-percent increase over 1974 totals, compared to a 9-percent overall growth for U.S. citizens (table B-4). The growth rate for foreign students, however, far exceeded U.S. citizens in

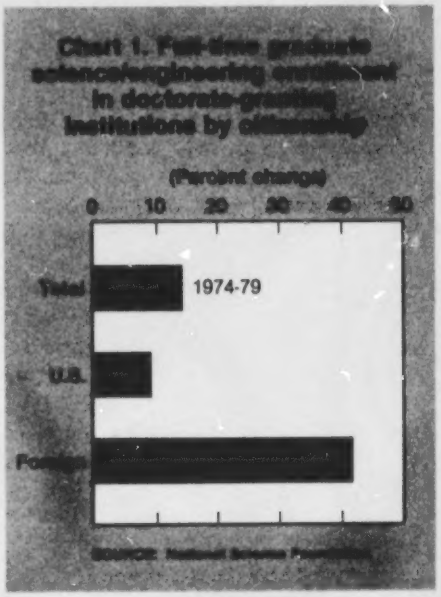


Chart 1. Full-time graduate science/engineering enrollment in doctorate-granting institutions by citizenship

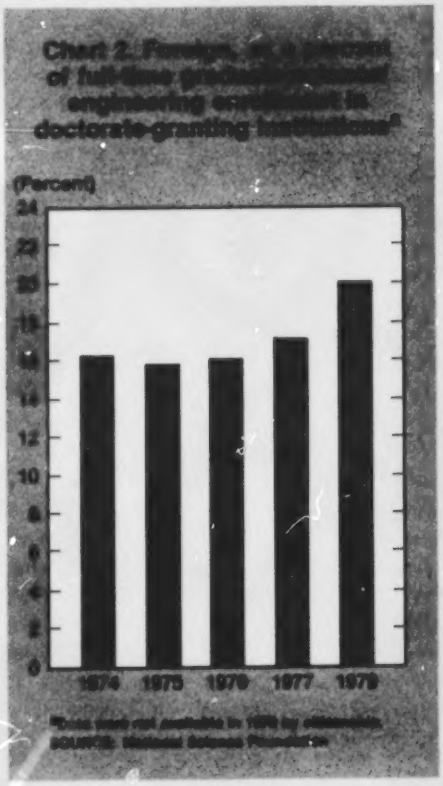


Chart 2. Foreign graduate students as percent of full-time graduate science/engineering enrollment in doctorate-granting institutions*

---

[8] Council of Graduate Schools (CGS), *Proceedings of the Fifteenth Annual Meeting*, "Selection Procedures and Criteria," December 1975, p. 48.

[9] CGS, *Proceedings of the Eighteenth Annual Meeting*, "Graduate Education for International Students-The Changing Pattern," December 1978, p. 128.

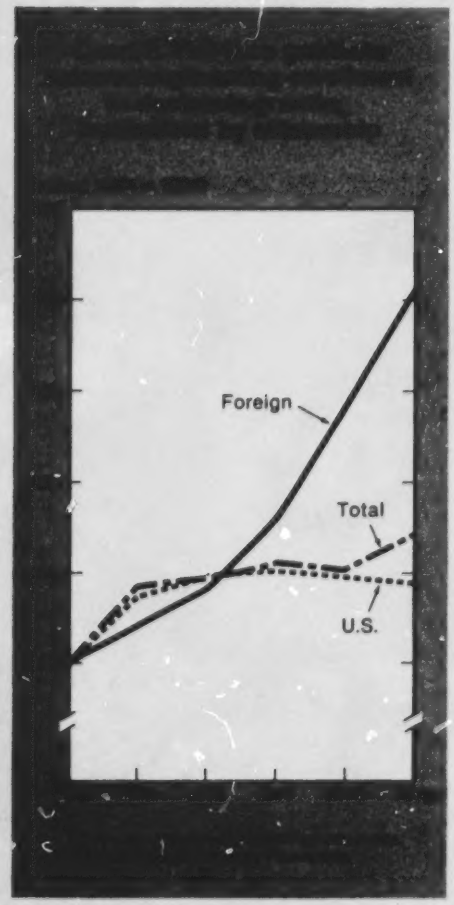
[10] IIE, op. cit., table 4.4, p. 28, and preliminary data for 1979/80.

[11] Association of American Colleges (AAC), *International Education: Trends 2000*, "Educational Policies in the Middle East," Volume 1, No. 4, (Washington, D.C., 1979), p. 105.

[12] Glaser, *op. cit.*, p. xxxix.

every year between 1975 and 1979 (chart 3). Although foreign students represented only one-fifth of the full-time S/E student population in 1979, they accounted for nearly 50 percent of the 28,200 net growth in students enrolled in graduate S/E programs on a full-time basis between 1974 and 1979. The increased demand by foreign students for training in S/E fields as reflected in these statistics coincides directly with the recent influx of students from OPEC and other less developed nations that require the high technology training offered by U.S. institutions.

The remainder of this subsection will discuss the distributional characteristics of full-time foreign graduate S/E student enrollments in doctorate-granting institutions. The fact that students are "full time" and "in doctorate institutions" will not be stated explicitly throughout the ensuing discussion. Since only 5 percent of the foreign S/E student population are enrolled full time at master's-granting institutions, a special subsection will deal exclusively with the characteristics of these students compared to foreigners studying at doctorate institutions.



fields of science and engineering

Over the 5-year span from 1974 to 1979, the proportion of foreign full-time graduate students enrolled in the various S/E disciplines did not change uniformly. For example, both the engineering and the mathematical/computer-science fields showed substantial increases in the concentration of foreign students enrolled, whereas in the life sciences, the foreign share of the graduate student population remained virtually unchanged. Many of the foreign students come from developing countries and have very different curriculum needs from those of U.S. students. Therefore, as the proportion of foreign students in particular fields increases, the possible impact on the characteristics and utility of graduate S/E education for U.S. students may well warrant closer attention in the future.

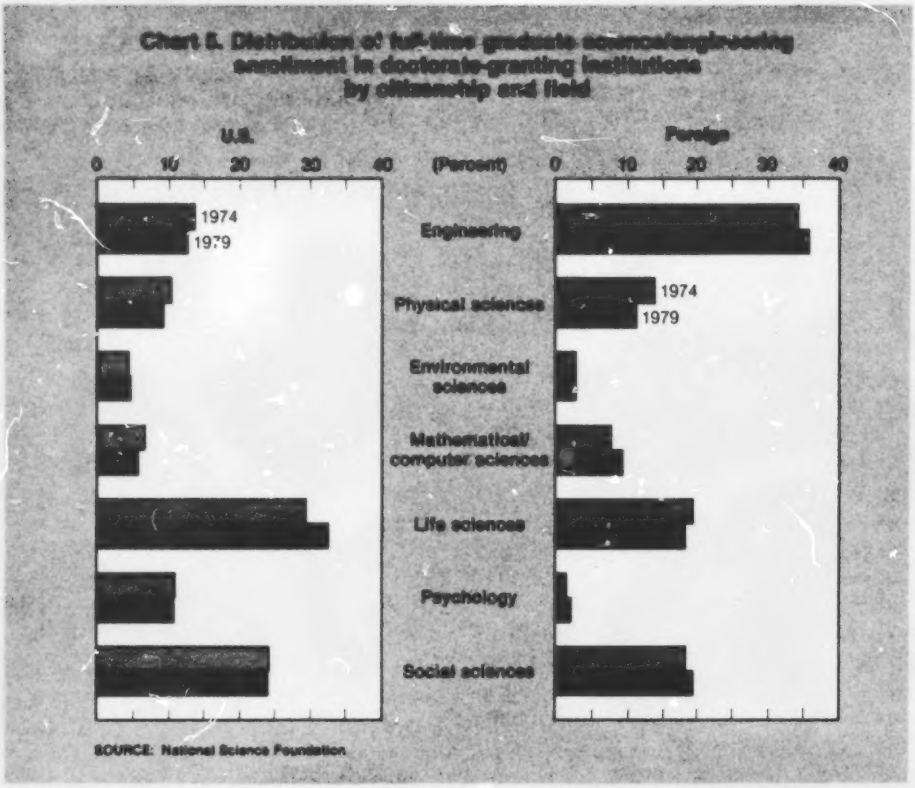
In all of the major field categories, foreign students represented an increasing share of the full-time graduate S/E population between 1974 and 1979 (chart 4). By 1979, four of every ten graduate engineering students in U.S. institutions were foreign, up from three out of ten in 1974; electrical and civil engineering continued to attract more foreign graduate students than the other engineering fields. Three of every ten graduate mathematical/computer science students were foreign, one more than in 1974. The increase in the proportion of physical science graduate students represented by foreigners was less striking. Within the physical-sciences category, however, the number of U.S. citizens enrolled in physics departments declined, whereas foreign enrollment increased over the same period, resulting in a 5-percentage point growth in the proportion of foreign to U.S. students during the 1974-79 period.

The distribution of foreign graduate students among the major fields of

science and engineering remained relatively stable in each field from 1974 to 1979 (chart 5). Engineering continued to draw the largest number of foreign graduate students, 35 percent of the total in 1979, a slightly larger share than in 1974, reflecting the continued high demand for technological training throughout the world. Also, as industry's demands for engineers draw more and more U.S. citizens away from graduate programs on university campuses, "the engineering schools are discovering that to recruit enough graduate students and junior faculty they must look increasingly to foreign-born nationals."[13] Many schools are utilizing

---

[13] Luther J. Carter, "Is Science and Engineering Training Adequate?" *Science*, Volume 208, April 4, 1980.

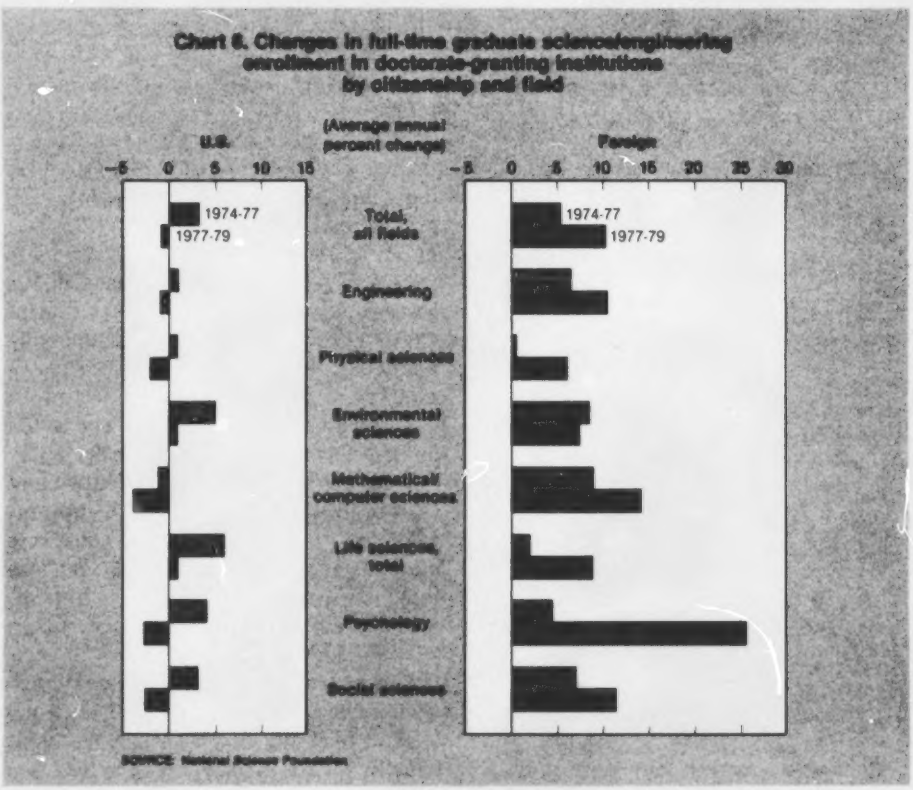


NRC were compared with data from the GSSP survey. Statistics from the latest year available from each source are shown for the three fields for which comparable data could be obtained: engineering, physical sciences (including environmental sciences), and life sciences (chart 7). For the three major fields and two of the three subfields under the life sciences, data indicate that the concentration of foreign students in the total student population increased as the academic level of study increased. Above the undergraduate level the highest concentration of foreigners occurred among postdoctorates. Except for the agricultural sciences where the total number of available postdoctoral appointments is decreasing, the proportion of foreign postdoctorates far exceeds that for full-time graduate S/E enrollment or S/E doctorate recipients—in some cases more than twofold. These high concentrations of foreigners can be attributed in part to two factors: (1) In recent years, U.S. citizens have shown

these foreigners in teaching positions in order to accommodate a recent boom that increased undergraduate engineering enrollment 69 percent between 1974 and 1979.[14] The social and mathematical/computer sciences also increased their proportions slightly. By comparison, the life science disciplines were the only areas in which a noticeable increase occurred in the proportion of U.S. citizens enrolled, up 4 percentage points during this same period.

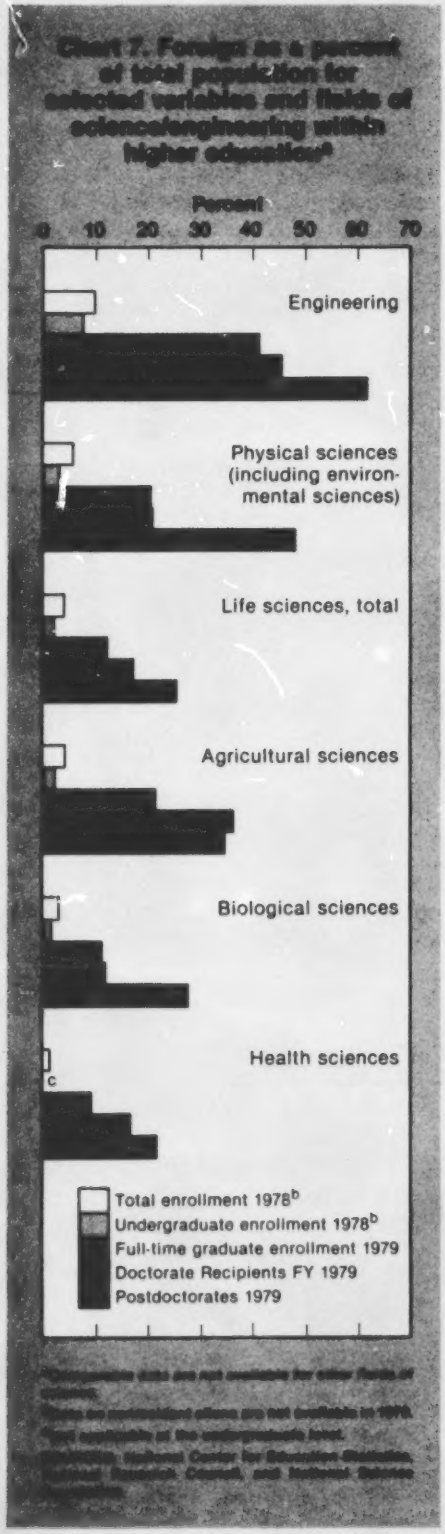
In all of the major field categories, the record for 1974-79 was one of growth in the enrollment of foreign students, with the largest rate increases occurring after 1977 for all but the environmental sciences (chart 6). Domestic enrollment, on the other hand, declined in all but the environmental and life science disciplines after 1977.

To gain additional perspective on how the concentration of foreign students increased in specified fields of study by academic level, data from NCES and



[14] *Ibid.*

an increased tendency to enter the labor market before achieving a doctorate degree (especially in engineering) because higher starting salaries have been offered to students with bachelor's and master's degrees; and (2) the relatively lower salaries offered to postdoctorates often make these positions less desirable to domestic students, thus enabling many ambitious nonresident aliens to accept less lucrative jobs that allow them additional research training as well as an opportunity to remain in the United States for an extended period.



institutional distribution

During the seventies, the Carnegie Council on Policy Studies in Higher Education classified academic institutions on the basis of their education and research programs.[15] The most recent classification (1976) ranked 98 doctorate-granting institutions as leading research universities. Institutions judged to be among this group of universities play a vital role in the continued advancement of U.S science and technology. Because such institutions historically have enrolled the largest numbers of foreign graduate S/E students, the prospect of continuing increases in foreign enrollment concomitant with declines in domestic enrollment may become an issue of growing importance to both university and public policy officials.

According to NSF data collected over the 5-year period 1974-79, the number of foreign full-time graduate S/E students attending the major U.S. research universities has increased markedly. In 1974, only 10 institutions enrolled more than 500 foreign students in full-time graduate S/E programs; by 1979 there were 19 such institutions (table B-5). The proportion of foreign graduate students attending the ten institutions that enroll the largest number of foreign graduate students has remained relatively stable during this period. These 10 institutions accounted for 21 percent of all foreign graduate students in 1979, compared to 23 percent in 1974. The leading 10 in 1979 included 8 universities that ranked in the top 10 in 1974, with the University of California at Berkeley and Massachusetts Institute of Technology ranking first and second, respectively, in both years (table 6).

The 98 major research institutions were further classified by the Carnegie Council into two groups: Research Universities I and Research Universities II (tables B-6 and B-7). Together, these

[15] Carnegie Council on Policy Studies in Higher Education, *A Classification of Institutions of Higher Education*, Revised Edition (Berkeley, Calif., 1976).

Table 6. Ten leading doctorate-granting institutions in foreign full-time graduate science/engineering enrollment: 1979 and 1974

Institution	Rank		Number		Percent change
	1979	1974	1979	1974	1974-79
Total, all institutions	—	—	44,800	31,700	41
Total, leading 10 institutions	—	—	9,170	7,090	29
University of Calif.-Berkeley	1	1	1,239	1,201	3
Massachusetts Institute of Technology	2	2	1,101	881	25
Ohio State University	3	8	1,002	610	64
University of Wisconsin-Madison	4	3	904	750	21
University of Michigan	5	9	874	600	46
University of Illinois-Urbana	6	7	864	686	26
Stanford University	7	4	861	725	19
University of Calif.-Los Angeles	8	13	830	467	78
University of Southern Calif.	9	15	774	451	72
Cornell University	10	5	722	711	2
All other institutions			35,620	24,610	45

SOURCE: National Science Foundation

two groups enrolled 75 percent of all foreign full-time graduate S/E students in 1979, slightly more than the 70-percent share who were U.S. citizens (table 7). More than one-half of all foreign graduate S/E students attended the 51 institutions named among the Research Universities I group.

The influence of engineering studies on the concentration of foreign graduate S/E students is apparent: Eight of the ten leading institutions in terms of foreign full-time S/E enrollment were also among the leading ten institutions in terms of foreign graduate enrollment in engineering (table 8). Only 5 of the top 10 institutions were among the leaders in enrollment in life science disciplines and 3 were among the leaders in social science enrollment (tables 9 and 10).

geographic distribution

The concentration of foreign students in our Nation's universities and colleges has become an issue of concern for many State legislatures. Fiscal restrictions in many State budgets have led to reductions in scholarships and other financial assistance to both domestic and foreign students; the cost to educate a student, however, has not diminished. In some States, legislatures are examining the possibility of charging foreign students out-of-State fees, and others may even consider charging the "full cost of education."[16] [17]

Since foreign students comprise more than one-fourth of the full-time graduate S/E population in three States (Iowa, Mississippi, and Oklahoma), this kind of

Table 7. Full-time graduate science/engineering enrollment in doctorate-granting institutions by citizenship and Carnegie classification: 1979

Carnegie classification	Number of institutions	Total		U.S.		Foreign	
		Number	Percent	Number	Percent	Number	Percent
Total, all classifications	322	224,060	100	179,230	100	44,800	100
Research Universities I	51	109,610	49	86,450	48	23,160	52
Research Universities II	47	49,230	22	38,560	22	10,670	24
All others	224	65,210	29	54,250	30	10,970	24

SOURCE: National Science Foundation

Table 8. Ten leading doctorate-granting institutions in foreign full-time graduate enrollment and doctorate degrees awarded in engineering: 1979

Institution by rank	Full-time graduate enrollment 1979			Doctorates awarded 1978/79[1]		
	Total	Foreign	Foreign as percent of total	Total	Foreign	Foreign as percent of total
Total, all institutions	39,280	16,180	41	3,230	1,050	33
Total, leading 10 institutions	11,139	4,340	39	1,050	390	37
1 University of Calif.-Berkeley	1,862	724	39	134	56	42
2 Massachusetts Institute of Technology	2,231	695	41	206	63	31
3 Stanford University	1,480	554	37	170	80	47
4 University of Michigan	937	432	46	126	46	37
5 University of Illinois-Urbana	975	345	35	166	46	28
6 Ohio State University	630	341	54	58	30	52
7 Univ. of Texas - Austin	706	331	47	40	21	53
8 University of Wisconsin-Madison	644	310	48	62	18	29
9 Georgia Institute Technology	952	307	32	28	14	50
10 University of Southern California	709	305	43	56	11	20
All other institutions	28,160	11,840	42	2,180	670	31

[1] Includes D. Eng. (engineering professional degree) and Ph.D.
SOURCE: National Science Foundation and Engineering Manpower Commission

Table 9. Ten leading doctorate-granting institutions in foreign full-time graduate enrollment in life science disciplines: 1979

Institution by rank	Total	Foreign	Foreign as percent of total
All institutions, total	66,540	8,150	12
Leading 10 institutions, total	11,380	2,050	18
1 University of Minnesota	1,863	278	15
2 University of California at Davis	1,380	267	19
3 University of Wisconsin-Madison	1,524	240	16
4 Michigan State University	1,182	212	18
5 Cornell University	930	202	22
6 Ohio State University	1,135	183	16
7 Kansas State University of Agriculture and Applied Science	486	180	37
8 University of Illinois-Urbana	937	164	18
9 University of California at Berkeley	1,311	163	12
10 Iowa State University of Science and Technology	632	162	26
All other institutions	55,160	6,100	11

SOURCE: National Science Foundation

[16] NAFSA, *235,000 Foreign Students in U.S. Colleges and Universities: Impact and Response* (Washington, D.C., 1979), p. 35.
[17] Daniel J. Zaffarano, in *Proceedings of the Eighteenth Annual Meeting, Council of Graduate Schools* (Washington, D.C., 1979), p. 120, stated that . . . "The GRADCOST study (1978) recently conducted by CGS showed that the cost of education for a graduate student usually far exceeds the assessed tuition and fees. It may cost up to $16,000 a year to educate a doctoral student in biochemistry. A typical tuition cost in a land grant university is $3,000 per year. Every foreign graduate student, therefore, receives some sort of subsidy from our institutions."

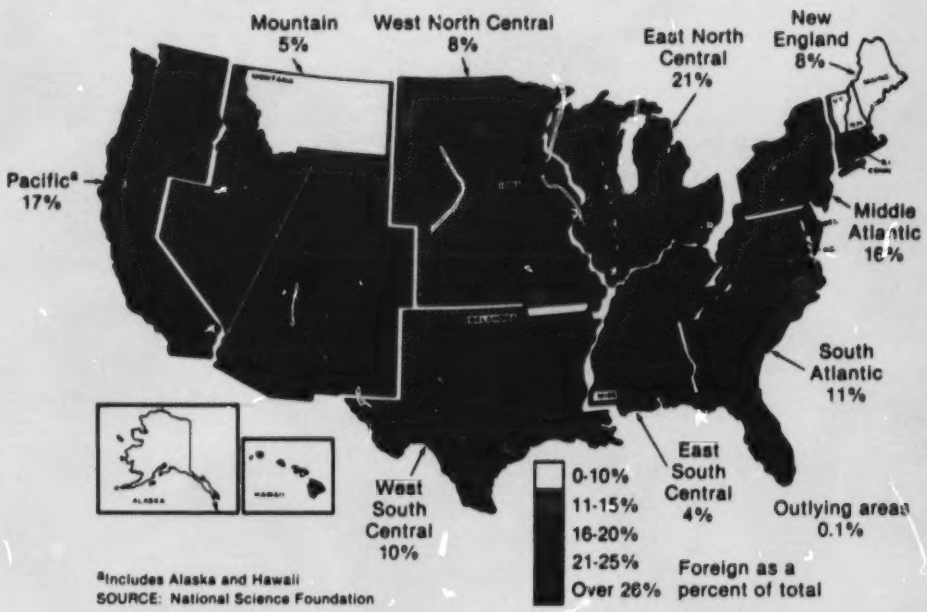
re-evaluation by State legislatures may have a serious impact on the enrollment outlook of foreign students (chart 8). All but one of the doctorate institutions in these three States in particular are State-controlled and thus offer reduced tuition to residents.[18]

Overall, the distribution of foreign graduate S/E students among major regions of the United States changed little from 1974 to 1979, with more than one-half enrolled full time at universities and colleges in the Middle Atlantic, East North Central, and Pacific regions in both years (table 11). California, New York, and Massachusetts led the Nation in the number of foreign students enrolled full time in graduate S/E programs in 1979, and accounted for 30 percent of the total; Texas and Ohio increased the share held by the leading five States to 40 percent (table 12).

California enrolled nearly 6,000 foreign graduate students in 1979, 42 percent more than in 1974. Texas and Ohio were the only other States among the leading 10 where the rate of growth in the number of foreign students exceeded that at the national level, 76 percent and 66 percent, respectively, for the 5-year period. Very few States recorded actual declines in the number of full-time foreign graduate S/E students; in fact, several States more than doubled their foreign graduate S/E enrollment (table B-8). The most prominent were Iowa, up 143 percent, and the District of Columbia, up 140 percent. The tremendous growth and high concentration of foreign students in the District of Columbia is primarily due to location. The close proximity of many foreign embassies and institutions such as the World Bank and the International Monetary Fund, which employ large numbers of foreigners, all contribute to the high number of foreign students seeking graduate education in the Washington, D.C., area.

[18] The University of Tulsa is the only privately controlled doctorate institution in these three States and it enrolled 66 foreign students in graduate S/E programs in 1979.

Chart 8. Foreign as a percent of full-time graduate science/engineering enrollment in doctorate-granting institutions by State: 1979



[a]Includes Alaska and Hawaii
SOURCE: National Science Foundation

Table 10. Ten leading doctorate-granting institutions in foreign full-time graduate enrollment in social science disciplines: 1979

Institution by rank	Total	Foreign	Foreign as percent of total
All institutions, total	51,730	8,780	17
Leading 10 institutions, total	8,460	2,020	24
1 University of Southern California	1,838	339	18
2 Columbia University - Main Division	866	224	26
3 Harvard University	938	196	21
4 University of Pennsylvania	576	191	33
5 Boston University	363	187	52
6 University of California at Los Angeles	1,006	185	18
7 University of Chicago	631	181	28
8 University of Hawaii at Manoa	411	173	42
9 University of Michigan	1,043	172	17
10 Michigan State University	782	170	22
All other institutions	43,270	6,760	16

SOURCE: National Science Foundation

Table 11. Geographic distribution of foreign full-time graduate science/engineering enrollment in doctorate-granting institutions: 1979 and 1974

Region	1979	1974
	Percent distribution	
Total	100	100
East North Central	21	21
Pacific[1]	17	17
Middle Atlantic	16	18
South Atlantic	11	10
West South Central	10	8
West North Central	8	8
New England	8	9
Mountain	5	5
East South Central	4	3
Outlying Areas	([2])	1

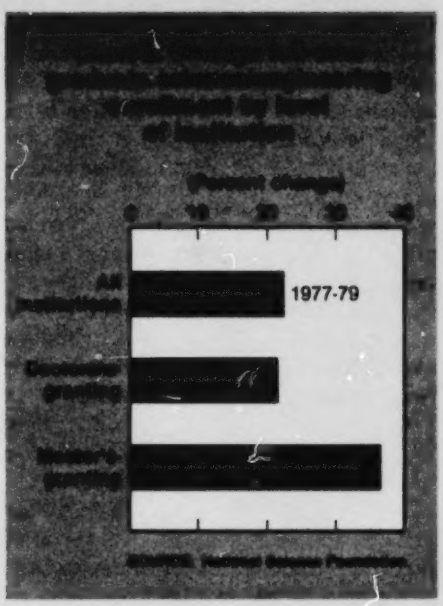
[1] Includes Alaska and Hawaii.
[2] Less than 0.05 percent.

SOURCE: National Science Foundation

Table 12. Ten leading States in enrollment of foreign full-time graduate science/engineering students in doctorate-granting institutions; 1979 and 1974

State	Rank		Number		Percent change
	1979	1974	1979	1974	1974-79
Total, all States			44,780	31,700	41
Total, leading 10 States			26,690	19,520	38
California	1	1	5,991	4,232	42
New York	2	2	4,215	3,602	17
Massachusetts	3	3	2,787	2,045	36
Texas	4	6	2,685	1,522	76
Ohio	5	7	2,441	1,469	66
Illinois	6	4	2,425	1,787	36
Michigan	7	5	2,100	1,670	26
Pennsylvania	8	8	1,971	1,410	40
Indiana	9	10	1,193	869	37
Wisconsin	10	9	1,086	913	19
All other States			17,900	12,180	47

SOURCE: National Science Foundation



foreign s/e students in master's-granting institutions

NSF's GSSP survey was expanded in 1976 to include master's-granting institutions. Data on the citizenship of full-time students, however, were collected only during the 1977 and 1979 survey years. This section deals briefly with the distributional characteristics of foreign S/E student enrollments at master's institutions compared to those at doctorate-granting institutions and also presents data on master's-level departments within doctorate institutions.

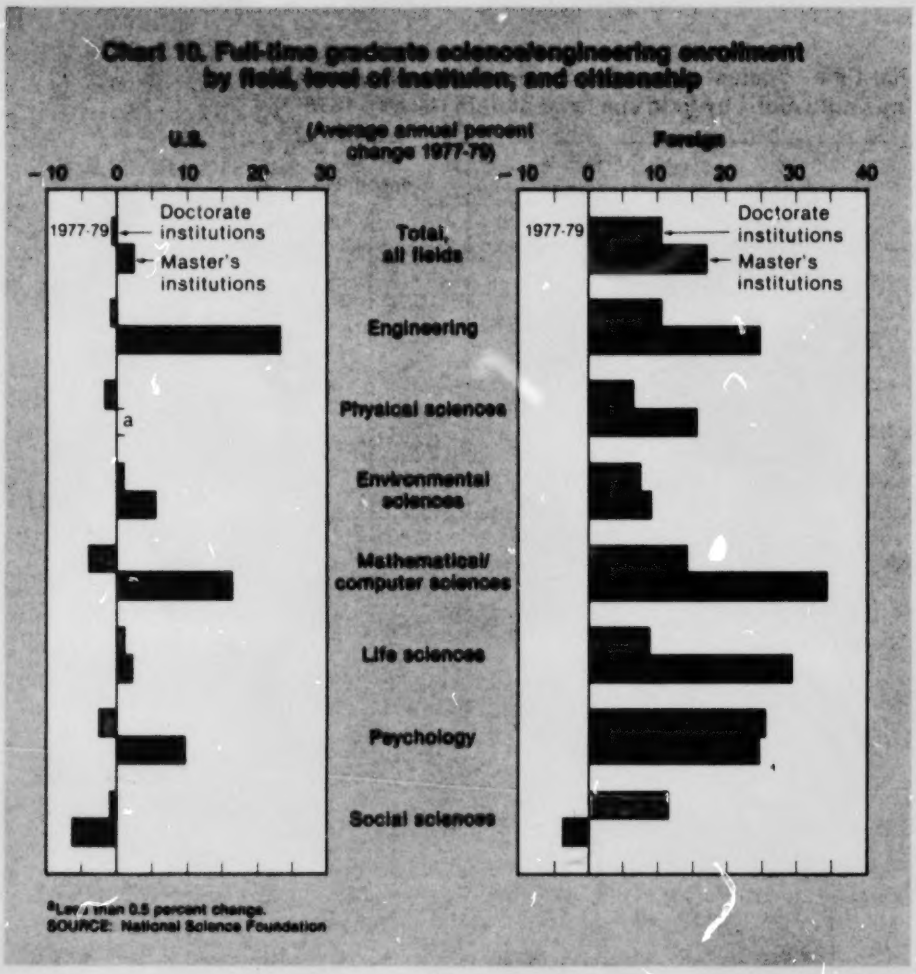
Although foreign students at master's-granting institutions accounted for less than 5 percent of the total S/E enrollment at all graduate institutions in both 1977 and 1979, their relative share of the total foreign student population has increased. The number of nonresident aliens enrolled at doctorate institutions increased 22 percent between 1977 and 1979, whereas master's institutions realized a 37-percent gain over the same 2-year period (chart 9 and table B-9).

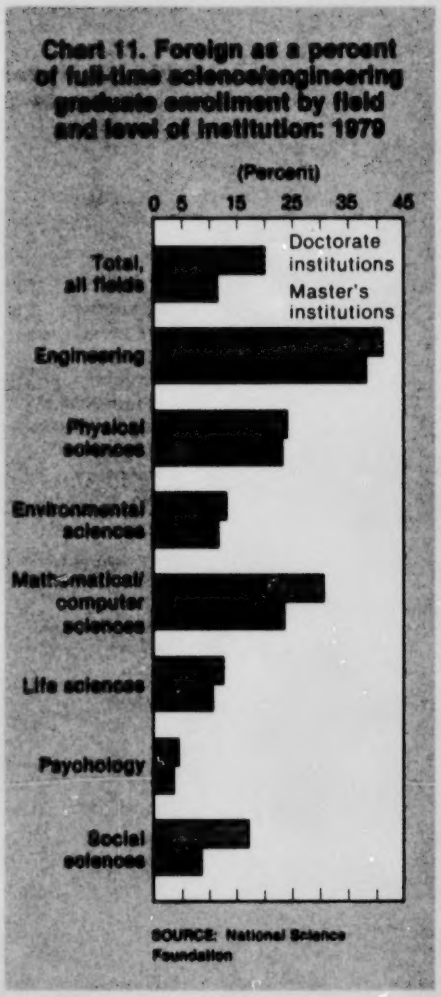
Although the growth rate among foreign graduate S/E students at master's institutions was relatively high between 1977 and 1979, it represented an increase of only 585 foreign students. The bulk of the increase took place in the life sciences and engineering, up 150 students in each field. Mathematical/computer sciences also accounted for a large number (131) of the additional foreign graduate S/E students at these same institutions (chart 10). Although the numbers of students involved are small, the relative growth rates are significantly larger than those at doctorate institutions in these fields.

Within master's institutions, the 2,200 foreign students enrolled full time in 1979 in graduate S/E programs accounted for only 11 percent of the total population compared to 20 percent at doctorate universities. The concentration of foreign students within fields of study did not vary significantly between doctorate and master's institutions except for social science programs. In doctorate-granting universities 17 percent of social science students were foreign, but at master's institutions only 9 percent were from countries other than the United States (chart 11).

institutional and geographic distribution

Only one master's-granting institution, West Coast University, enrolled more than 100 foreign full-time graduate students in S/E programs in 1979 (table B-10). The leading 10 master's institutions in the enrollment of foreign graduate students accounted for 27 percent of the foreigners but only 14 percent of the total number of full-time S/E students at master's institutions. The proportion of foreign students to total graduate S/E enrollment within these 10 schools ranged from 7 percent at San Francisco State University to 70 percent at Alabama A&M University.





Six of the 10 master's institutions with the largest number of foreign S/E graduate students in 1979 were in California, where more than one-third of all foreign students were enrolled (table 13). Texas, the second leading State, enrolled another 10 percent, New York followed with 8 percent, and Illinois (6 percent) was the only other State with more than 100 foreign graduate S/E students at master's institutions.

Table 13. Five leading States in foreign full-time graduate science/engineering enrollment in master's institutions: 1979

State	Foreign enrollment	Total enrollment	Foreign as percent of total
Total, all states	2,180	19,270	11
Total, leading 5 States	1,340	10,740	13
California	738	6,109	12
Texas	209	1,568	13
New York	185	1,671	10
Illinois	134	1,105	12
Alabama	98	292	34
All other States	840	8,530	10

SOURCE: National Science Foundation

master's-level departments

Foreign full-time enrollment in master's-level departments in doctorate-granting institutions reached 4,400 in 1979, up 33 percent since 1977—almost the same rate as that at master's institutions (37 percent). These master's departments enrolled 10 percent of the total foreign graduate S/E population at doctorate institutions (table 14). When examined as a whole, all master's departments (at both types of institutions) enrolled barely 14 percent of the total number of foreign graduate S/E students in U.S. colleges and universities in 1979, yet that proportion has been increasing. Enrollment in master's departments may be expected to increase at a faster rate than in doctorate-level departments if course offerings more closely reflect the actual needs of the foreign student.

Table 14. Foreign full-time graduate science/engineering enrollment in doctorate-granting institutions by field and level of department: 1979

Field	All graduate departments		Master's departments		Doctorate departments	
	Number	Percent distribution	Number	Percent distribution	Number	Percent distribution
Total, all fields	44,800	100	4,440	100	40,450	100
Engineering	16,179	36	1,160	26	15,019	37
Physical sciences...	5,187	12	229	5	4,958	12
Environmental sciences	1,280	3	144	3	1,136	3
Mathematical/-computer sciences	4,253	10	669	15	3,584	9
Life sciences	8,153	18	1,060	24	7,093	18
Psychology.....	961	2	56	1	905	2
Social sciences	8,782	20	1,125	25	7,657	19

Note: Detail may not add to total due to rounding.

SOURCE: National Science Foundation

section 2

foreign recipients of U.S. s/e doctoral degrees

Slightly more than one of every five S/E doctorates awarded in 1979 by universities in the United States was received by a foreign citizen. In the field of engineering, foreign citizens constituted almost one-half of the graduating doctorates. Foreign participation in U.S. S/E graduate education has had multiple effects, some domestic and some international. An obvious example of the latter is the transfer of advanced technological knowledge to other parts of the world, particularly to developing countries, through U.S.-educated, foreign Ph.D. recipients. In this case the primary beneficiary is the foreign country.

Foreign doctorate recipients who choose to remain in the United States after graduation have definite effects on the domestic labor supply, although immigration laws and regulations are intended to minimize the displacement of U.S. citizens. The recent increased tendency of U.S. baccalaureates in engineering and computer science to become employed full time rather than to enter full-time S/E graduate study has resulted in a dearth of doctorates in these fields. Under such circumstances, there might be a demonstrable benefit to the United States from the participation of foreign citizens in graduate education in this country if these students remained in the United States after graduation. Over the longer term, however, there may be reason for concern about our growing dependency on foreign sources for our supply of S/E personnel.

This section presents information that may further illuminate the nature of these benefits and costs. It examines trends in S/E doctorate production, indicates the nature of the foreign demand for U.S. graduate training in science and engineering, and provides information on doctorates awarded to foreign citizens and on their career intentions. In addition, it identifies the subspeciality fields in which significant proportions of the doctorates granted are awarded to foreign students.

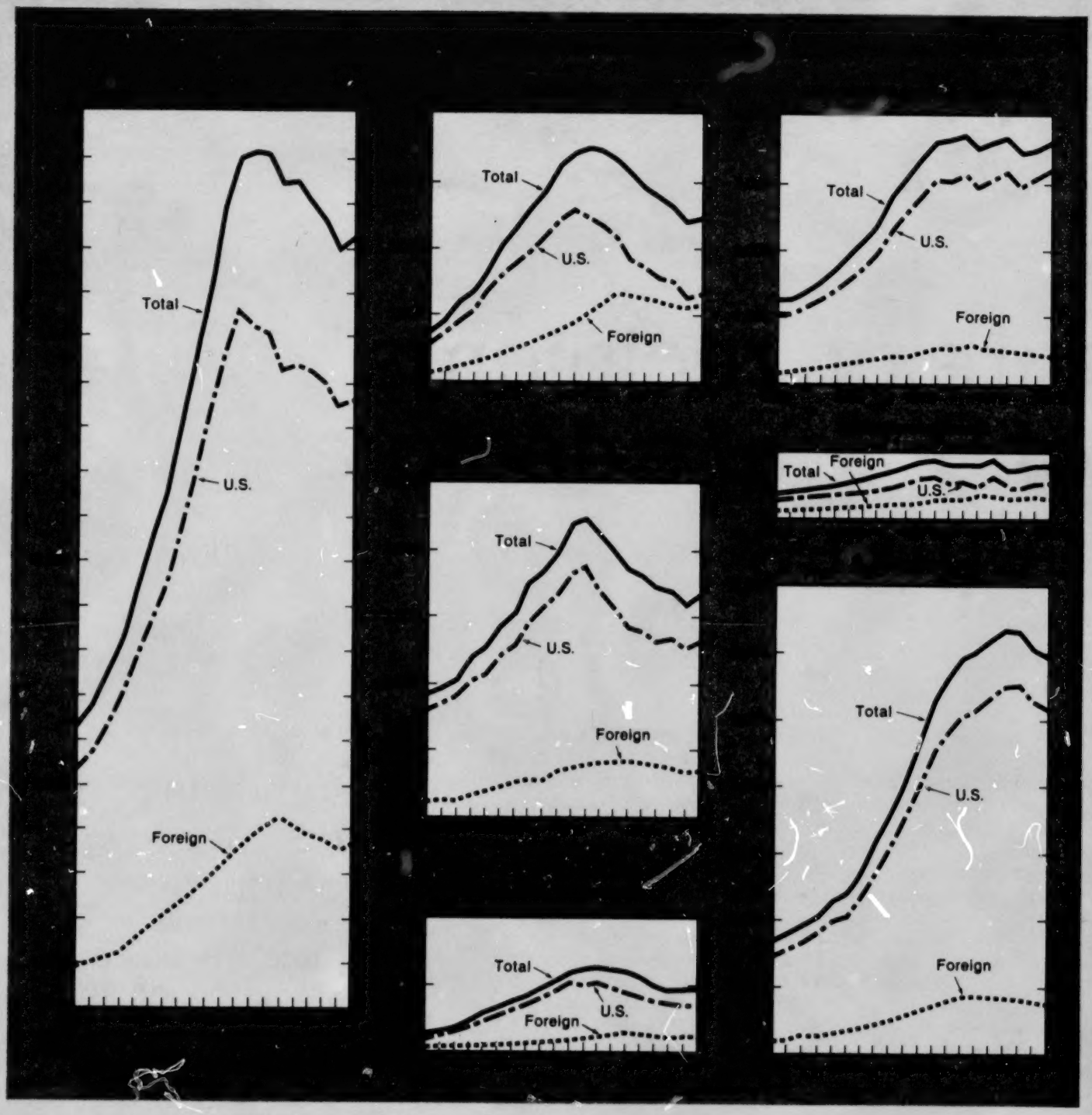
long-term trends in s/e doctorate production

total s/e doctorate production

The increasing trend in total annual S/E doctorate production during the sixties was reversed in the early seventies. S/E Ph.D. production increased over 200 percent in the period 1960-72 and then declined 10 percent between 1972 and 1979 (chart 12).[19]

---

[19] Data from table B-11 used in the text are adjusted in the following manner: individuals in the category "citizenship not known" are allocated to the "U.S. citizens" and "foreign citizens" categories in the same proportions as those with known citizenship.


Total
U.S.
Foreign
Total
U.S.
Foreign
Total
U.S.
Foreign
Total
Foreign
U.S.
Total
U.S.
Foreign
Total
U.S.
Foreign
Total
U.S.
Foreign

The steep rise in the sixties reflected a combination of demographic and political factors. The age-cohort from which doctorates are produced—25- to 34-year-olds—rose between 1960 and 1970 after having declined between 1950 and 1960.[20] In addition, Federal activities in the defense and space programs encouraged pursuit of higher education in S/E fields.

In the early seventies, the Federal Government began to deemphasize direct support to graduate S/E students through fellowship and traineeship programs, in response to an abundant supply of doctorates in certain disciplines. In the midseventies Federal academic support policies began to affect graduate students indirectly, however, by (1) providing increased opportunities for research assitantships, and (2) by strengthening undergraduate education through loans and grants programs. Some of these policies are now changing. In addition, while direct Federal support in the early seventies was declining, the growth of undergraduate enrollment was tapering off, contributing to the decline in S/E Ph. D. production between 1972 and 1979.

The 1960-79 trends were generally the same in most S/E fields as the trends for S/E totals—a rise from 1960 to the early seventies and then a slow decline until 1979. The peak in the field of social sciences occurred a little later, in 1976. The relative declines from the peak to 1979 were more marked in the mathematical and physical sciences and in engineering than they were in the other science fields.

Acquisition of S/E doctorates by U.S. citizens declined in most fields during the period 1970-79, particularly in engineering (48 percent) and in the mathematical and physical sciences (about 30 percent). In the latter fields, falling production may have been a response by potential doctorates to the lack of employment opportunities in academia, the traditional area of employment for Ph.D. scientists and engineers. In engineering, potential doctorates may well have lost their incentive for further study because of the favorable opportunities in business and industry for engineers with only a bachelor's degree.[21]

foreign-citizen s/e doctorate recipients

The number of foreign citizens receiving S/E doctorates from U.S. universities also grew continuously in the sixties and early seventies, more than quadrupling between 1960 and 1974. A 14-percent decline occurred between 1974 and 1979, following the drop in graduate-school enrollments for all foreign citizens that had occurred between 1971 and 1974.[22] This enrollment decline was caused primarily by a reduction in the number of "immigrants" (i.e., foreign citizens with permanent resident status) and may have been the result of changes in immigration practices. Poor S/E job opportunities for U.S. citizens in the early seventies made it harder for foreign citizens to qualify for immigration certification under regulations of the Department of Labor.

The number of foreign-citizen Ph.D.'s in non-S/E fields also showed increasing trends between 1960 and 1979. These parallel movements indicate that there were factors affecting foreign Ph.D. production beyond those specific only to science and engineering. In non-S/E fields, however, foreign citizens accounted for only 6 percent of the total doctorates in 1960 (compared with 15 percent for S/E doctorates), and only 10 percent in 1979 (compared with 21 percent of S/E doctorates). There has been little concern about the foreign demand

[20] Bureau of the Census, Department of Commerce. *Statistical Abstract of the United States, 1978* (Washington, D.C.: Supt. of Documents, U.S. Government Printing Office), p. 6.

[21] College Placement Council. *Salary Survey*, July 1979.

[22] The decline among Ph.D. recipients was most heavily concentrated in the life sciences (excluding agriculture), 29 percent from its high in 1974, and in the physical and mathematical sciences with declines of 20 percent and 18 percent, respectively, from their peak year (1973 for physical sciences and 1974 for mathematical sciences).

for U.S. doctorates in these fields because their share of doctorates is small.

foreign-citizen participation in total s/e doctorate production

The foregoing trends produced some striking changes between the sixties and the seventies in the foreign-citizen share of S/E doctorate production (table 15). The share of S/E doctorates earned by foreign citizens rose slowly from 1960 to 1974 and remained relatively stable at slightly more than one-fifth through 1979.

In most individual S/E fields the share of doctorates awarded to foreign citizens in the seventies rose more rapidly than in the sixties and in some fields it grew substantially. For example, the share rose steadily in engineering until it constituted almost one-half of the degree production in 1979. In agriculture the share peaked at just over two-fifths in 1974, and declined to slightly more than one-third in 1979.

labor market implications

The growing number of foreign citizens among new S/E doctorates could affect domestic labor markets if many of them choose to remain in the United States after receiving their degrees. Trends in Ph.D.'s earned by "immigrants" (permanent residents) compared with "nonimmigrants" (temporary residents), are revealed by examining data for selected years between 1960 and 1979 in table 15. The bulk of Ph.D.'s awarded to foreign citizens in all S/E fields (over 7 out of 10) went to nonimmigrants rather than to immigrants in 1979. This is important because it is the nonimmigrants whose future plans to remain in the United States are uncertain.

The data suggest that the impact of foreign citizens on the domestic labor force of S/E doctorates is small overall, but significant in some fields, particularly engineering. In the seventies, only 6 percent of the total S/E doctorate pool, but over 12 percent of the engineering

Table 15. Number and percent distribution of Ph.D. recipients by type of citizenship for selected years

	Total science/engineering fields				
	1960	1965	1970	1975	1979
Number of Ph.D.'s awarded	6,300	10,500	17,800	18,500	17,200
	Percent				
U.S.	85	83	82	78	79
Foreign	15	17	18	22	21
Permanent residents (immigrants)	(3)	(3)	(6)	(7)	(6)
Temporary residents (nonimmigrants)	(12)	(14)	(12)	(15)	(15)

	Physical sciences					Mathematical sciences					Engineering				
	1960	1965	1970	1975	1979	1960	1965	1970	1975	1979	1960	1965	1970	1975	1979
Number of Ph.D.'s awarded	1,900	2,900	4,400	3,600	3,300	300	700	1,200	1,100	1,000	800	2,100	3,400	3,000	2,500
	Percent														
U.S.	88	86	84	77	79	81	86	84	76	74	77	79	75	58	53
Foreign	13	15	16	23	21	19	14	16	24	26	23	22	26	42	47
Permanent residents (immigrants)	(3)	(3)	(6)	(8)	(6)	(4)	(3)	(5)	(7)	(7)	(7)	(6)	(12)	(14)	(13)
Temporary residents (nonimmigrants)	(10)	(12)	(10)	(15)	(15)	(15)	(11)	(11)	(17)	(19)	(16)	(16)	(14)	(28)	(34)

	Agriculture					Life sciences (excl. Agric.)					Social sciences				
	1960	1965	1970	1975	1979	1960	1965	1970	1975	1979	1960	1965	1970	1975	1979
Number of Ph.D.'s awarded	400	600	800	900	900	1,200	2,000	3,400	3,600	3,600	1,700	2,400	4,600	6,200	5,900
	Percent														
U.S.	74	67	70	63	65	85	81	84	85	88	86	87	86	86	87
Foreign	26	33	30	37	35	15	19	16	15	12	12	13	14	14	13
Permanent residents (immigrants)	(4)	(3)	(5)	(8)	(3)	(3)	(3)	(4)	(6)	(4)	(3)	(3)	(5)	(4)	(3)
Temporary residents (nonimmigrants)	(22)	(30)	(25)	(29)	(32)	(12)	(16)	(12)	(9)	(8)	(9)	(10)	(9)	(10)	(10)

Note: Percents calculated from unrounded numbers. Detail may not add to total due to rounding.

SOURCE: National Science Foundation and National Research Council, unpublished tabulations.

doctorates, were awarded to immigrants (table 15). In addition, it is estimated that over one of every five nonimmigrants had employment commitments in the United States (chart 13).[23] Given the share of S/E doctorates awarded in the seventies to nonimmigrants, the estimated share of total S/E-doctorate production represented by nonimmigrants who plan to stay and work at least temporarily, is about 2 percent to 3 percent. The potential impact of nonimmigrants on domestic labor supply is more dramatic in engineering. It is estimated that almost two-fifths of the nonimmigrant Ph.D. recipients in engineering in 1979 plan to remain in the United States.[24] They constitute 13 percent of all doctorates awarded in engineering in 1979.

For all foreign citizens—both immigrants and nonimmigrants—NSF estimates that about 1 in 12 of the S/E doctorates produced (7 percent) was awarded to a foreign citizen with employment commitments in the United States. In engineering, approximately 1 in 4 of the doctorates produced (26 percent) in 1979 was awarded to foriegn citizens with such commitments.

The immediate labor market implications of these findings are trivial. Production of new doctorates each year represents only 5 percent of the doctoral S/E labor force. Thus, the estimated number of S/E doctorates awarded annually to foreign citizens with employment commitments in the United States represents only about one-half of 1 percent of the S/E labor force with doctorates. Even in the field of engineering, the immediate labor market implication is negligible; the estimated number of engineering doctorates awarded annually to foreign citizens with such plans represents only about 1 percent of the engineering labor force with doctorates.

Ultimately, however, as these incremental effects cumulate, the labor-market implications may be significant. For example, if one assumes that the engineering doctoral labor force will remain stable at the 1979 level of approximately 50,000, and if nonimmigrant doctorate engineers with definite employment commitments in the United States are eventually permitted to stay permanently, foreign citizens could represent about one-sixth of this labor force by 1990.

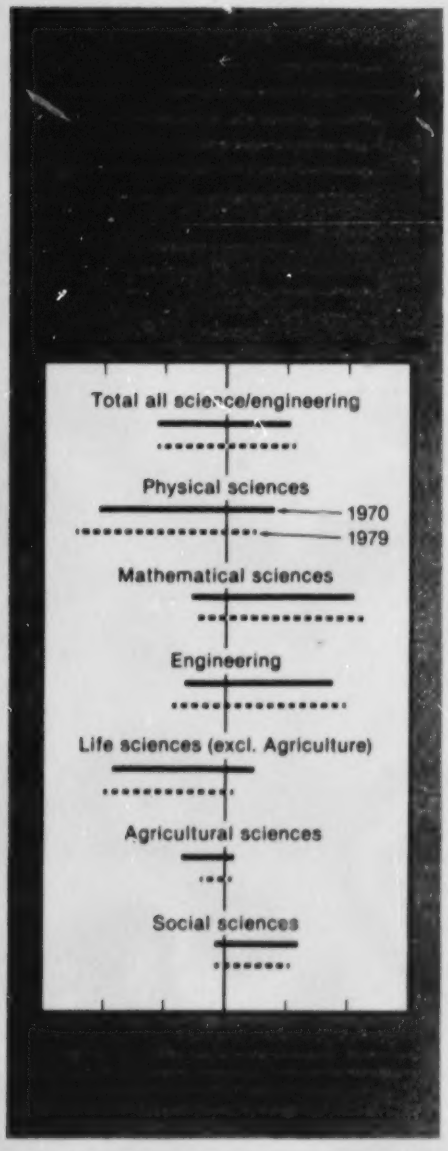
Some observers[25] see this increasing dependence of U.S. engineering on foreign citizens arising because fewer U.S. citizens are electing to attend engineering graduate school.[26] Thus, it would appear that these foreign engineering doctorates are not displacing U.S. citizens; rather, they are filling a need that is not met by U.S. citizens. Their relative effectiveness, however, particularly in teaching positions where language difficulties could present handicaps, cannot be assessed with the data available for this study.

implications for s/e graduate studies

The increased prevalence of foreign-citizen doctorates in engineering and in agricultural, mathematical and physical sciences may indicate the following: (1) The pressing need for high-technology people in the underdeveloped regions of the world—suppliers of most foreign-citizen doctorate recipients, and (2) the desire of foreign-citizen Ph.D.'s to find employment in advanced countries. The relative importance of these phenomena are clearly field dependent.

The field of agricultural sciences seems to typify the first type of phenomenon. Both the number and the proportion of foreign citizen Ph.D. recipients in agricultural sciences, for example, increased during the seventies—from 30 percent in 1970 to 35 percent in 1979 (table 15). In contrast to the

[23] This estimate is based on the roughly two-thirds of the foreign citizens who indicated that they had definite plans and assumes that the remaining one-third would have distributed themselves in the same manner as the two-thirds who responded (table B-12). The estimate would have been about 15 percent if all of the nondefinites had indicated no plans to stay and work in the United States; it would have been almost 50 percent if all of the nondefinites had indicated that they planned to stay and work in the United States.



[24] This estimate is based on the roughly two-thirds of the 1970 foreign engineering doctorates who had indicated that they had definite plans and assumes that the remaining one-third would have distributed themselves in the same manner as the two-thirds with definite plans (table B-12). The estimate would have been a little more than 1 in 4 if all of the nondefinites had indicated that they had no plans to stay; it would have been 3 in 5 if all of the nondefinites had indicated that they planned to stay.

[25] David Ullman. *Engineering Education for the 21st Century. Proceedings*. Vol. 1. ASEE. June 1980. and Luther Carter. "Is Science and Engineering Training Adequate?", *Science*. Apr. 4, 1980.

[26] Data from the National Science Foundation. *Academic Science: Graduate Enrollment and Support, Fall 1979* (NSF 80-321) (Washington, D.C.: Supt. of Documents, U.S. Government Printing Office) show the number of U.S. citizens enrolled for full-time graduate study in engineering departments in doctorate institutions declining from 25,284 to 23,103 between 1975 and 1979. Correspondingly, foreign full-time graduate enrollment in engineering rose in numbers—11,854 to 16,179—and in percent of total—from 32 to 41—between 1975 and 1979. The incentive of beginning salaries of over $20,000 per year for engineering baccalaureates in industry no doubt holds tremendous drawing power for most young U.S. citizens.

field of engineering, however, only a few foreign-citizen doctorates in agricultural sciences have remained in the United States for employment.

In general, fields of interest to foreign countries can be ascertained by considering the proportion of Ph.D.'s awarded to foreign citizens with temporary visas since these "nonimmigrants" are more likely to leave the United States after receipt of their degrees than foreigners with immigrant status. More than 40 subspecialty fields—largely among engineering and the mathematical, physical, and agricultural sciences—reported that "nonimmigrants" received at least 20 percent of the Ph.D.'s awarded in 1979 (table 16). These statistics reflect the needs of developing countries for basic high-technology expertise in the hard sciences as well as the more applied skills needed in areas such as agriculture, engineering, and economics. Fuel technology/petroleum engineering and agricultural engineering reflected the highest proportions of doctorates awarded to nonimmigrants—67 percent and 59 percent, respectively—reasonable percentages because a majority of the foreign citizens coming to the United States are from regions of the world that are largely agrarian or rich in petroleum.

In 1970-79, the largest number of foreign students—more than one-half—receiving doctorates in science or engineering from universities in the United States were from Asia and the Middle East (table 17).

Table 16. Science/engineering subspeciality fields[1] in which 20 percent or more of Ph.D.'s awarded were received by foreign citizens with temporary visas: 1979

Field	Number of Ph.D.'s awarded to all citizens	Percent of Ph.D.'s awarded to foreign citizens with temporary visas
Engineering		
Fuel technology, petroleum	24	67
Agricultural	66	59
Civil	236	43
Aeronautical and astronautical	81	43
Engineering, other	76	41
Metallurgy and physical metallurgy	87	39
Engineering mechanics	85	36
Electronics	83	37
Computer	79	
Materials science	125	34
Chemical	267	34
Operations research	66	32
Mechanical	282	31
Industrial	83	28
Electrical	451	26
Nuclear	95	25
Engineering, general	33	24
Engineering, physics	17	24
Systems design, systems science	75	21
Mathematics		
Mathematics, general	81	27
Applied	111	26
Operations research	43	23
Probability, mathematical statistics	165	22
Analysis and functional analysis	111	20
Physics and astronomy		
Physics, general	196	24
Plasma	62	24
Optics	46	22
Nuclear structure	103	20
Solid state	243	20
Physics, other	112	20
Chemistry		
Polymer	67	33
Chemistry, general	128	21
Earth, environmental, and marine sciences		
Atmospheric sciences, other	42	26
Agricultural sciences		
Soils and soil science	71	54
Agronomy	138	41
Agriculture, other	84	34
Food, science and technology	107	33
Animal science and animal nutrition	112	30
Forestry	87	25
Phytopathology	88	24
Horticulture	69	23
Biological sciences		
Parasitology	21	24
Social sciences		
Statistics	23	48
Agricultural economics	153	44
Economics	780	25
Econometrics	22	23

[1] Fields in which fewer than 10 Ph.D.'s were awarded in 1979 are excluded from this list.

SOURCES: National Science Foundation and National Research Council

Table 17. Number and percent of foreign-citizen Ph.D. recipients in science/engineering fields by primary area of origin: 1970-79

Area of origin	Total science/engineering fields		Physical sciences		Mathematical sciences		Engineering		Life sciences (excl. agric. sci.)		Agricultural sciences		Social sciences	
Total world regions	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Eastern Asia[1]	36,900	100	7,700	100	2,400	100	11,300	100	5,000	100	3,000	100	7,500	100
Western Asia[2]	9,500	26	2,600	33	600	26	3,200	29	1,400	27	500	18	1,200	16
Other world regions	9,100	25	1,700	22	500	21	3,700	33	1,000	19	700	24	1,600	21
	18,300	49	3,400	45	1,300	53	4,400	38	2,600	54	1,800	58	4,700	63

[1] Eastern Asia includes Burma, China, Taiwan, Japan, Korea, Malaysia and Vietnam.

[2] Western Asia includes the countries of the Middle East and Cyprus, Turkey, India and Pakistan.

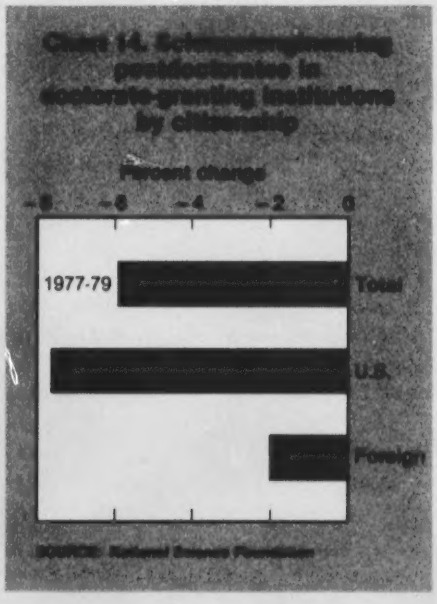
SOURCE: National Science Foundation

section 3

foreign s/e postdoctorates in doctorate-granting institutions

NSF's definition of postdoctorates, whether U.S. citizens or foreign nationals, refers to those who devote full time to research activities; they are generally employed on a short-term basis and have no faculty rank or responsibility. Most postdoctorate appointees consider such employment as training opportunities in their specialties and as stepping stones to more permanent positions. Several factors influence the choices made by department heads and research investigators as to the utilization of postdoctorates on research projects: experience in the specific field, institutional hiring policies, flexibility of the budget, available graduate student skills, and timing. The selection of a foreigner to fulfill the research support function of a particular research effort is sometimes based on availability alone. In some fields, foreigners holding doctorates are more plentiful than are U.S. doctorate holders.

The GSSP survey by NSF provides statistics on the total number of postdoctorates employed in graduate S/E departments of doctorate institutions for 1974 through 1979 and on their citizenship for 1977 and 1979. From this survey it is evident that the buildup of S/E postdoctorate employment that occurred in the midseventies slowed by the late seventies. Between 1974 and 1979—the total number rose from 16,700 to 18,600, or by 12 percent. A drop of 6 percent in postdoctoral utilization, however, was reported by graduate S/E departments between 1977 and 1979, the first downturn since the data series began. Foreign postdoctorates, representing only about one-third of the 1979 total, showed a 2-year drop of 2 percent, and U.S. citizens holding these positions declined at an even faster pace, nearly 8 percent (chart 14 and table B-13).

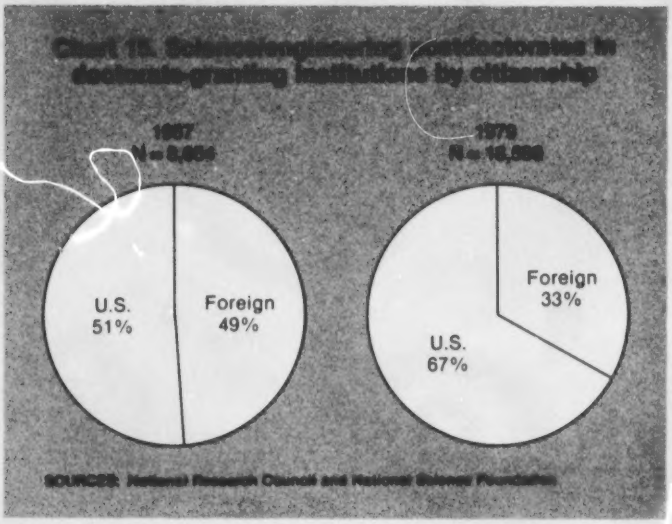


The role of foreign postdoctorates in 1979 has changed markedly since 1967, the last year in which a comprehensive study of postdoctoral characteristics was undertaken. NRC conducted a detailed survey that year, from which it determined that foreign postdoctorates represented 45 percent of the 10,700 postdoctorates employed throughout the United States and 49 percent of the nearly 8,700 total employed in all fields by academic institutions (chart 15).[27] This relatively large representation of foreigners holding academic postdoctoral positions in 1967 was explained as follows:

> "Language difficulties as well as lack of faculty opportunities at research oriented universities for all but the very best foreign postdoctorals probably account for the attractiveness of postdoctoral appointments for those who want to prolong their stay in the United States."[28]

---

[27]National Research Council, The Invisible University, (Washington, D.C., 1969), tables 5 and 27.
[28]NRC, *op. cit.*, p. 104.



The diminished share of foreign S/E postdoctorates in the academic employment picture between 1967 and 1979 is in contrast to the growing proportions of both foreign graduate students enrolled full time in S/E programs and foreign doctorate recipients in science and engineering. As shown earlier, the number of foreign students rose from a 16-percent share of the full-time S/E student total in 1974, to 20 percent by 1979 (chart 2). Also, the proportion of foreign S/E doctorate recipients to all S/E doctorate recipients rose from 15 percent in 1960 to 21 percent in 1979, as shown in the previous section (table 15).

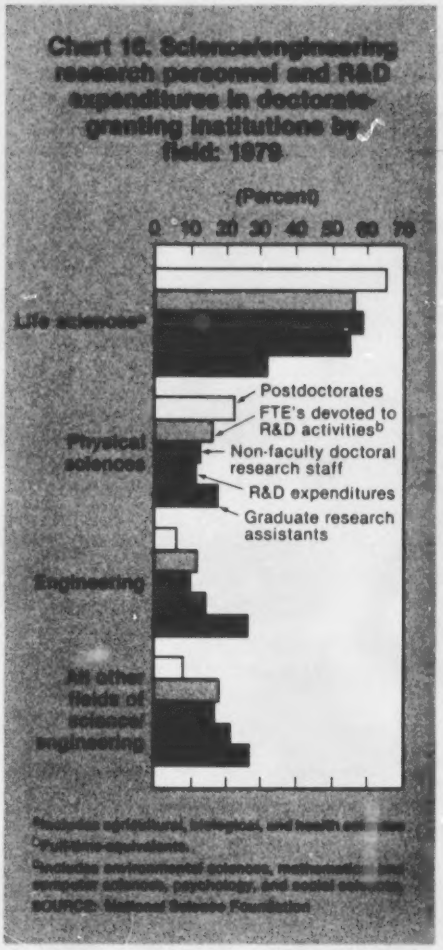
A closer look at the utilization patterns of foreign postdoctorates in U.S. universities is in order in view of the rise in the seventies of research and development (R&D) expenditures by universities and the subsequent impact of this growth on the hiring patterns of institutions.

fields of science and engineering

Although foreign nationals represented only one-third of the postdoctorates employed by doctorate institutions in S/E fields, their impact varies considerably among disciplines. It is important to examine not only their distributional patterns among S/E programs, but also the ratio of foreigners to U.S. citizens in each field.

The life sciences dominated the research activity of academic personnel in 1979, a reflection of the high level of R&D expenditures in these fields (chart 16). Over two-thirds of all postdoctorates were employed in life science departments, programs that attracted the highest proportion of full-time-equivalent (FTE) scientists and engineers devoted to R&D activities, nonfaculty doctoral research staff, and graduate research assistants as well.[29] In this context, the employment patterns of foreign postdoctorates can be more easily understood.

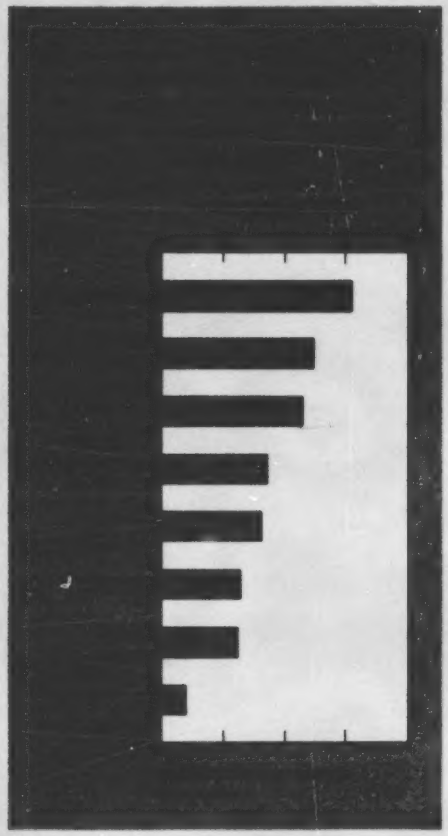
Although life science graduate departments utilized over one-half of the 6,100 foreign postdoctorates in 1979, foreigners represented only one of every four of the total postdoctorates employed in the life sciences. Thus, their importance to the research effort of these departments can be assumed to be of lesser consequence than that of U.S. citizens. In contrast, three of every five postdoctorates employed in engineering departments were foreigners, a field where their impact on research programs is significantly greater (chart 17). The proportion of foreigners employed as postdoctorates follows closely the pattern shown earlier of the field-of-science distribution of foreign graduate students enrolled full time in 1979; the mathematical/computer science departments ranked second in student participation and the physical sciences third (chart 4).



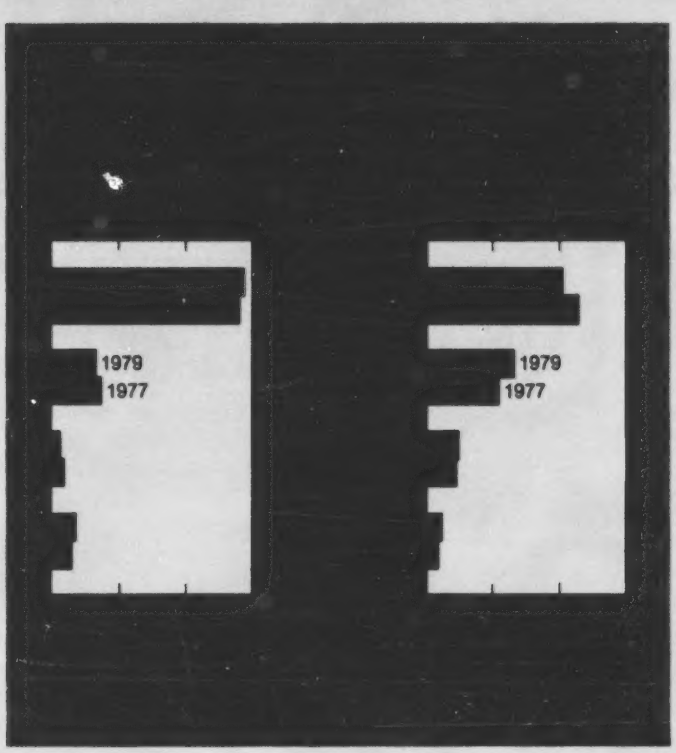
Although there were slight shifts in the distributional patterns between the life sciences and the physical sciences in the two years for which data were collected, these fields continued to be the prime interest of postdoctorates regardless of citizenship (chart 18). An examination of the life sciences by detailed subfield, however, revealed a decided difference in the utilization patterns of foreign compared to U.S. citizen postdoctorates. U.S. citizens were more heavily involved in both biological and health disciplines than were foreign postdoctorates (table B-14). Whereas 31 percent

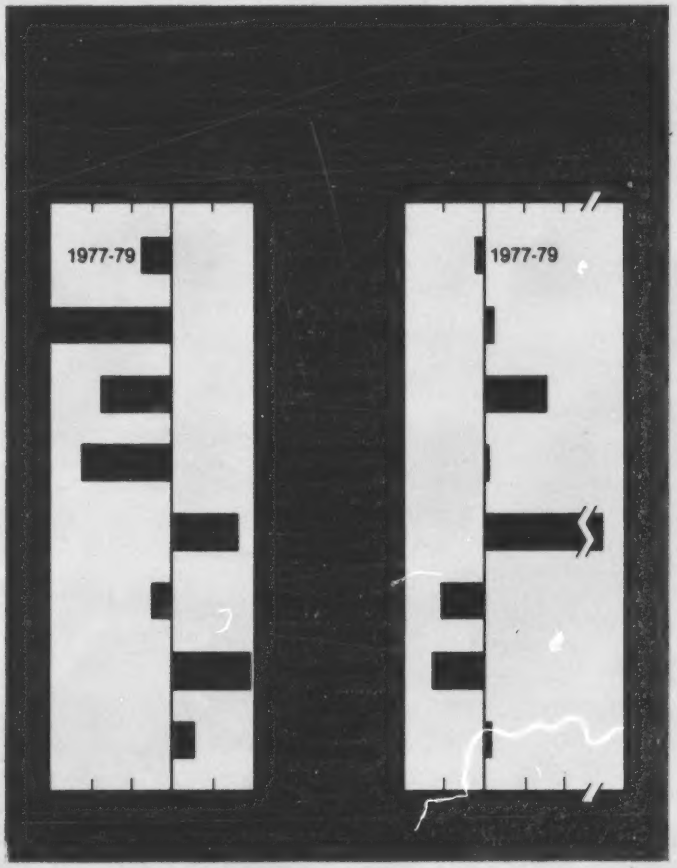
[29]Several NSF surveys provided the data for this analysis: Survey of Scientific and Engineering Expenditures at Universities and Colleges, FY 1979; Survey of Scientific and Engineering Personnel at Universities and Colleges, January 1980; and the Survey of Graduate Science Students and Postdoctorates, Fall 1979.

of the foreigners were employed in biological science departments, 39 percent of U.S. citizens were so employed. The difference in proportion in the health sciences was even greater—19 percent of the foreigners compared to 32 percent of the U.S. citizens. Biochemistry was a relatively popular field for foreign as well as U.S.-citizen appointees; biology and microbiology drew large numbers of foreign postdoctorates, as did pharmacology. The clinical sciences attracted a higher percentage of U.S. citizens than of foreigners.



Other significant fields of interest to foreign postdoctorates in both 1977 and 1979 were the physical sciences and engineering. Seven of ten of those employed in the physical sciences were in chemistry departments. The two predominant engineering fields in foreign postdoctorate utilization were chemical engineering and metallurgical and materials engineering, where 4 in 10 were employed. Departments in the environmental sciences, mathematical/computer sciences, psychology, and social sciences employed relatively few





foreign postdoctorates, and they were widely dispersed among the individual disciplines. These distributional characteristics were approximately the same in both public and private institutions.

Two fields of science registered losses in foreign postdoctorates between 1977 and 1979—the life sciences, reflecting the impact of a 25-percent decline in the number of foreign postdoctorates in the health sciences, and psychology, where the number of foreign postdoctorates was the lowest of all the fields (38 in 1977) and thus a loss of a few appointees had a relatively large impact (chart 19). The drop in postdoctorate utilization in the life sciences affected U.S. citizen appointees also, but to a lesser extent. The downturn in life science appointments in academia can be explained in part by the concurrent increase in employment of life scientists throughout the economy. NSF estimated that between 1974 and 1978, employment of life scientists increased by 22 percent in all sectors, so that there may have been some movement away from academic employment and into private industry and Government positions (table B-15).[30] Another indicator of the demand for life scientists is shown in the NSF projections of the full-time labor force of doctoral scientists and engineers from 1977 to 1987.[31] The life sciences are expected to show a significant increase in the doctoral labor force in this period, a growth rate that is exceeded only by the social sciences and engineering. This momentum should affect both U.S. and foreign doctorate-holders.

institutional distribution

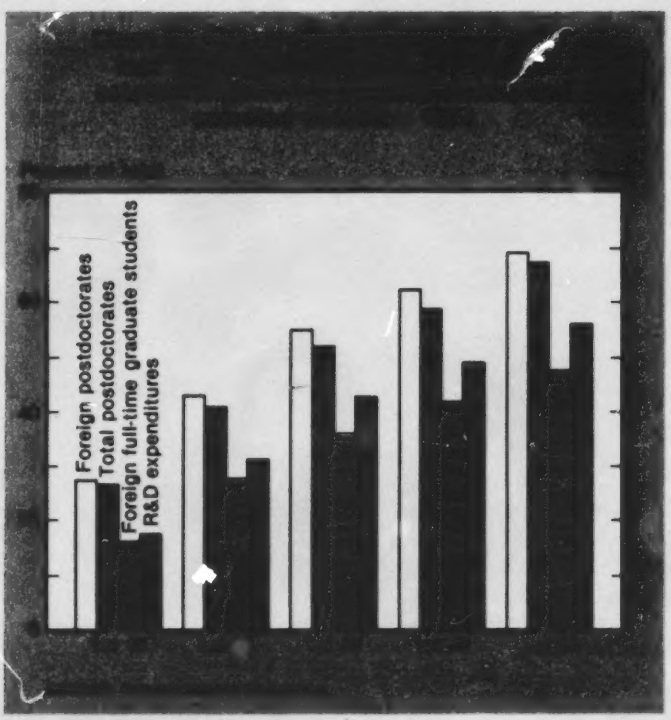
A major determining factor in the increased employment of research personnel has been the growth in academic R&D spending in the sciences and engineering. Administrative practices that were used with increasing frequency in the seventies by institutions with large research programs were the hiring of short-term and part-time personnel and increasing employment of nontenured doctoral research staff and graduate research assistants. An NSF special report on employment patterns of academic scientists and engineers concluded that the 3-percent per year average growth rate in S/E employment reported by doctorate-granting institutions between 1973 and 1978 could be traced to increased research performance over this period, up by more than 9 percent in real-dollar terms.[32]

[32]National Science Foundation, *Employment Patterns of Academic Scientists and Engineers, 1973-78* (NSF 80-314) (Washington, D.C.: Supt. of Documents, U.S. Government Printing Office), p. 5.

In this atmosphere of expanding research opportunities, it is important to examine the role of foreign postdoctorates in the institutions that employ the largest numbers. In 1979, 7 of 10 of the foreign Ph.D.-holders, and nearly the same proportion of U.S. Ph.D.-holders who held postdoctoral positions were clustered in 50 doctorate-granting institutions (chart 20 and table B-16). These same 50 institutions accounted for 56 percent of the total separately budgeted R&D expenditures in fiscal year 1979, and enrolled 47 percent of the foreign graduate students studying full time in the sciences and engineering.

The leading 10 institutions in terms of foreign postdoctorate utilization employed over one-quarter of the total, with Harvard University utilizing the greatest number (table 18). Seven of these 10 universities were also the top institutions in terms of foreign graduate science enrollment, as seen earlier (table 6).

A lower proportion of foreigners was employed in 1979 by medical schools, only 24 percent, than by graduate schools, 40 percent, a pattern that prevailed in the enrollment of foreign graduate students as well (chart 21 and table B-17). This higher representation of foreigners in graduate schools was influenced primarily by the specific fields



[30]National Science Foundation, *U.S. Scientists and Engineers: 1978* (Detailed Statistical Tables) (NSF 80-304) (Washington, D.C.), table 2, p. 4.

[31]National Science Foundation, *Projections of Science and Engineering Doctorate Supply and Utilization, 1982 and 1987* (NSF 79-303) (Washington, D.C.: Supt. of Documents, U.S. Government Printing Office), table 3, p. 5.

in which they were employed; e.g., engineering, physical, mathematical/computer sciences, and environmental sciences all employed a higher proportion of foreigners than did the life sciences (chart 17).

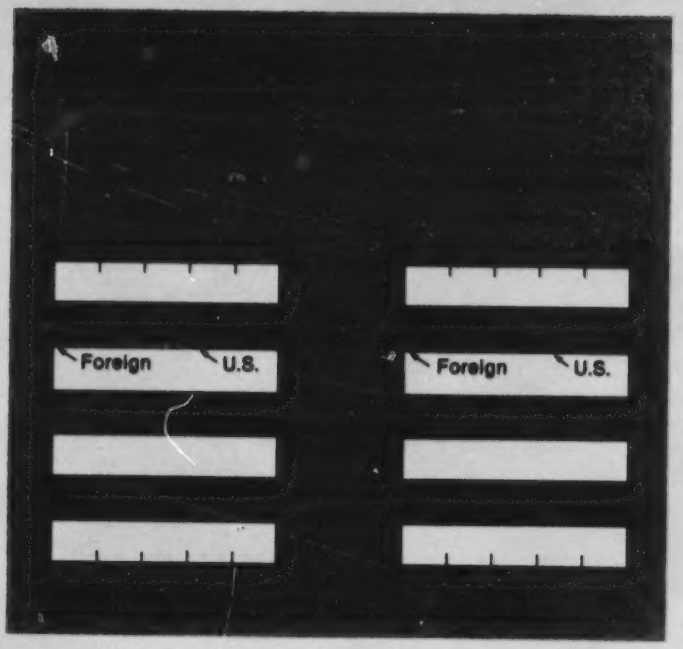


Table 18. Ten leading institutions in foreign science/engineering postdoctorate employment: 1979

Institution	Rank	Number	Percent distribution
Total, all institutions		6,080	100
Total, leading 10 institutions		1,649	27
Harvard University	1	297	5
University of California-Berkeley	2	189	3
Stanford University	3	171	3
Massachusetts Institute of Technology	4	160	3
University of Wisconsin-Madison	5	158	3
University of California-Los Angeles	6	146	2
University of Southern California	7	143	2
Cornell University	8	139	2
University of California-San Francisco	9	127	2
Yale University	10	120	2
All other institutions		4,430	73

SOURCE: National Science Foundation

geographic distribution

California led the Nation in its utilization of foreign postdoctorates, employing 18 percent of the 1979 total, up from 16 percent in 1977 (table 19). As shown earlier on table 18, 5 of the leading 10 institutions in foreign postdoctorate employment were located in California, accounting for its high rank. The three leading States—California, New York, and Massachusetts—together employed 41 percent of the foreign postdoctorate total, and these same three States also led in the enrollment of foreign graduate students (table 12).

Although the 10 leading States showed relatively little overall change in employment of foreign postdoctorates between 1977 and 1979, the remaining States reported a total decline of 6 percent.

In relative terms, Kentucky was the leading State in its share of foreigners employed as postdoctorates; Mississippi reported the lowest proportional representation and South Dakota was the only State reporting no foreign postdoctorates in 1979 (chart 22 and table B-18).

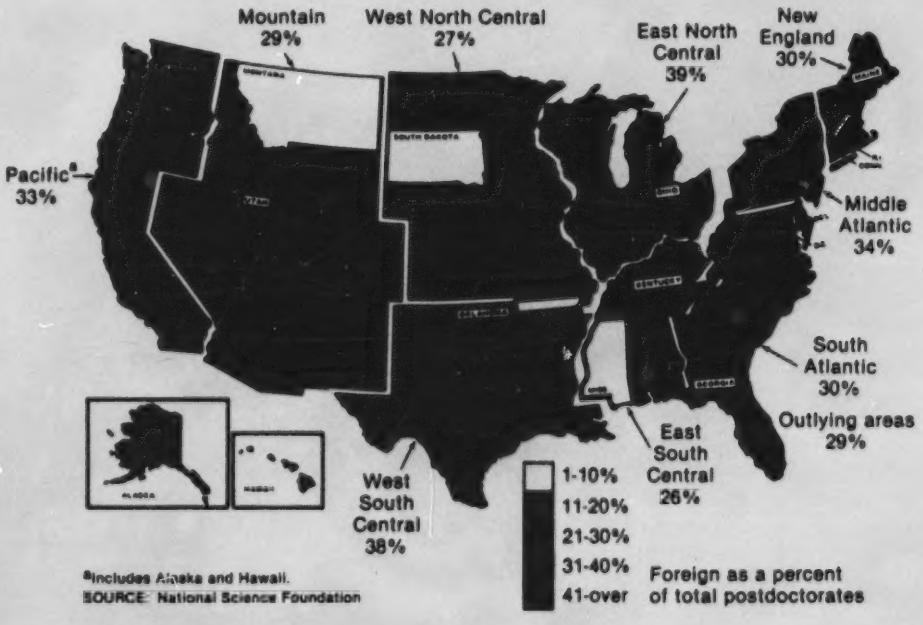
Table 19. Ten leading States in 1979 employment of foreign science/engineering postdoctorates in doctorate-granting institutions: 1979 and 1977

State	Rank		Number		Percent change
	1979	1977	1979	1977	1977-79
Total, all States			6,080	6,200	- 2
Total, leading 10 States			4,170	4,180	(a)
California	1	1	1,121	1,002	12
New York	2	2	760	818	- 7
Massachusetts	3	3	583	626	- 7
Texas	4	6	403	290	39
Illinois	5	4	315	361	-13
Pennsylvania	6	5	290	315	- 8
Ohio	7	7	208	214	- 3
Wisconsin	8	10	178	159	12
Maryland	9	8	160	211	-24
Connecticut	10	9	156	182	-14
All other States			1,900	2,020	- 6

[a]Less than 0.05 percent change.

SOURCE: National Science Foundation

Chart 22. Foreign as a percent of total science/engineering postdoctorates in doctorate-granting institutions by State: 1979



[a]Includes Alaska and Hawaii.

SOURCE: National Science Foundation

appendixes

a. technical notes
b. statistical tables
c. survey form and instructions

appendix a

technical notes

data sources

Section 1 of this report draws heavily upon data collected annually from institutions of higher education by IIE and published in its *Open Doors* series. The Annual Survey of Foreign Students provides information on the total number of foreign students and their countries of origin, sex, degree level or type of program, primary source of funds, marital status, and enrollment status. The definitions of these data elements and the taxonomy used conform to those specified in the Higher Education General Information Surveys (HEGIS) conducted by NCES in the Department of Education. Data for the academic year 1979-80 were released for NSF use prior to publication.

The analytical treatment in section 1 on graduate S/E students in doctorate-granting institutions is based on statistics provided by the NSF GSSP survey for the years 1974 through 1979. The 1979 survey universe included 8,363 graduate S/E departments in 322 doctorate-granting institutions and 1,452 departments in 315 master's-granting institutions. In all, 611 graduate schools and 141 medical schools were surveyed for a total of 752 reporting units. Of these, only 14 failed to respond. Within the responding institutions, 208 departments required total imputation and 427 required partial imputation (table A-1). The survey form included the following data elements: Full-time graduate students according to their major source and type of support received, sex, citizenship, and level of study; and part-time graduate students in terms of sex and level of study. The resulting statistics are presented by detailed subfields of seven major S/E disciplines and are published in NSF's report, *Academic Science: Graduate Enrollment and Support, Fall 1979* (Detailed Statistical Tables) (NSF 80-321).

Data on proportions of foreign graduate students in several S/E disciplines were compared with the percentage of nonresident aliens enrolled in these same fields by using NCES 1978 tabulations from the Fall Enrollment and Compliance Report of Institutions of Higher Education (NCES 79-317), table 29, and the press release dated March 19, 1980, entitled, "Nonresident Alien Enrollments and Degrees Are Increasing," (NCES 80-B05), table D.

Table A-1. Imputation for nonresponse at doctorate-granting institutions by citizenship: 1979

Item	Total	U.S.	Foreign
Full-time students	224,057	179,362	44,795
Number imputed	5,557	3,887	1,670
Percent imputed	2.5	2.2	3.7
S/E postdoctorates	18,589	12,514	6,075
Number imputed	636	501	135
Percent imputed	3.4	4.0	2.2

SOURCE: National Science Foundation

The universities responding to the NSF's GSSP survey were classified according to their "research intensity" by using the Classification of Institutions of Higher Education updated in 1976 by the Carnegie Council on Policy Studies in Higher Education. The rankings of institutions that are shown in this report were based on the following criteria:

1.1 **Research Universities I.** The 50 leading universities in terms of Federal financial support of academic science in at least two of the three academic years, 1972-73, 1973-74, and 1974-75, provided they awarded at least 50 Ph.D.'s (plus M.D.'s if a medical school was on the same campus) in 1973-74. Rockefeller University was included because of the high quality of its research and doctoral training, even though it did not meet these criteria.

1.2 **Research Universities II.** These universities were on the list of the 100

leading institutions in terms of Federal financial support in at least two out of the above three years and awarded at least 50 Ph.D.'s (plus M.D.'s if a medical school was on the same campus) in 1973-74. At least 25 of these degrees must have been Ph.D.'s. Alternatively, the institution was among the leading 60 institutions in terms of the total number of Ph.D.'s awarded during the years from 1965-66 to 1974-75. In addition, a few institutions that did not quite meet these criteria, but that have graduate programs of high quality and with impressive promise for future development, have been included in 1.2.

The data presented in section 2 were from the *Survey of Earned Doctorates*, an annual survey of doctorate recipients from U.S. universities. The survey was sponsored by NSF, the Department of Education, NIH, and the National Endowment for the Humanities, and is conducted by the Commission on Human Resources in NRC. Data collected concerned (1) sex, citizenship, and racial or ethnic group; (2) education history including field of degree; (3) sources of graduate student support; (4) employment status during year preceding doctorate; and (5) information concerning postgraduation plans. The detailed questions are shown on the questionnaire (appendix C) used to survey the doctorate recipients for academic year 1979. The questionnaire is distributed with the cooperation of the deans of graduate schools and is filled out by the graduates when they complete all requirements for their doctoral degrees. In 1979, 275 doctorate-granting institutions distributed questionnaires to doctorate recipients; 96 percent of the new doctorates responded. The nonrespondents are represented in the data base with information from public records such as official commencement lists. This survey includes research doctorates with degrees such as D.Sc., S.J.D., D.L.S., Th.D., and Ed.D., but excludes professional doctorates such as M.D., D.D.S., and D.V.M.

Data from the *Survey of Earned Doctorates* for 1958 (the year of the introduction of this questionnaire) through 1979, are recorded on the Doctorate Records File (DRF), a file of individuals who have earned doctorates from U.S. universities since 1920. For individuals who received doctorates between 1920 and 1957, the data in the DRF are less comprehensive. The DRF is now a computerized file of over 630,000 doctorate recipients.

Between July 1, 1978, and June 30, 1979, U.S. universities awarded 31,200 doctorates in all fields (table A-2). This number constitutes an increase of 328 or 1.1 percent over the 30,872 doctorates awarded in 1978.

The 275 doctorate-granting institutions included in the 1979 *Survey of Earned Doctorates* were limited to those that (1) were regionally accredited, and (2) offered research doctorates. These limitations, plus the fact that some public university systems have centralized the conferral of the Ph.D. and other research doctorates at a single campus, accounted for the differences in the numbers of institutions for which data are reported in sections 1 and 2.

Data on foreign doctorate recipients by S/E disciplines were obtained from special tabulations of the *Survey of Earned Doctorates*.

For section 3, the data on foreign postdoctorates were derived from item 8 of the GSSP survey, fall 1977 and 1979. An expansion of item 8 to add a data cell on "nonfaculty doctoral research staff" may have created an artificial downturn in the total number of postdoctorates reported in 1979 when compared to those reported in 1977. The separation of "nonfaculty doctoral research staff" may have resulted in reporting problems for those institutions that had previously included these staff members under the postdoctorate category. Instructions to the 1980 form were revised accordingly so that institutions would treat these categories as separate entities.

Two other NSF surveys of academic institutions provided discipline data illustrated in charts 16 and 20: (1) the Survey of Scientific and Engineering Personnel Employed at Universities and Colleges; and (2) the Survey of Scientific and Engineering Expenditures at Universities and Colleges.

survey response rates

Mailout of the 1979 GSSP survey was completed in early January 1980 and the survey was closed out in early July 1980, when a 98-percent institutional response rate was achieved among doctorate-granting institutions and 97 percent for master's-granting institutions.

Missing data were machine-imputed and the impact of this procedure on the data reported by citizenship is illustrated in table A-1. There was an overall imputation rate of less than 3 percent of the full-time enrollment total in doctorate institutions—2 percent of the U.S. students and 4 percent of the foreign students. For the postdoctorate population the rates were reversed—2 percent of the foreign postdoctorates were imputed and 4 percent of the U.S. citizens, for an overall imputation rate of 3 percent.

Table A-2. Number of doctorate recipients in all fields from U.S. universities: 1960-79

Year	Number	Year	Number	Year	Number
1960	9,733	1967	20,406	1974	33,048
1961	10,413	1968	22,938	1975	32,953
1962	11,500	1969	25,746	1976	32,945
1963	12,730	1970	29,500	1977	31,718
1964	14,325	1971	31,872	1978	30,872
1965	16,341	1972	33,044	1979	31,200
1966	17,949	1973	33,756		

Note: Each year the majority of doctorates are conferred in science and engineering. In academic year 1979, U.S. universities awarded 17,230 doctorates in science/engineering. Further detail on science/engineering doctorates appears in table B-11.
SOURCE: National Research Council, unpublished tabulations

appendix b

statistical tables

Page

B-1. Number of foreign students reported in, and number of institutions responding to IIE's Open Doors Survey: 1954/55-1979/80 29

B-2. Foreign enrollment from OPEC countries for selected years: 1954/55—1979/80 29

B-3. Foreign full-time graduate students in doctorate-granting institutions by science/-engineering fields: 1974-77 and 1979 30

B-4. Full-time graduate students with U.S. citizenship in doctorate-granting institutions by science/engineering fields: 1974-77 and 1979 32

B-5. Doctorate-granting institutions ranked by number of foreign full-time students in graduate science/engineering fields: 1979 34

B-6. Research Universities I ranked on foreign full-time graduate science/engineering enrollment: 1979..... 35

B-7. Research Universities II ranked on foreign full-time graduate science/engineering enrollment: 1979..... 36

B-8. Foreign full-time science/engineering graduate students in doctorate-granting institutions by geographic distribution: 1974-77 and 1979..... 37

B-9. Foreign full-time graduate students in master's-granting institutions by science/engineering field: 1977 and 1979... 39

B-10. Master's-granting institutions ranked by number of foreign full-time students in graduate science/engineering fields: 1979 40

B-11. Number of Ph.D. recipients in science/engineering by field and type of citizenship: 1960-79 ... 41

B-12. Number of foreign Ph.D. recipients in science and engineering, immigrant and nonimmigrant, and postgraduation plans: 1970 and 1979 44

B-13. Foreign science/engineering postdoctorates in doctorate-granting institutions by field: 1977 and 1979 46

B-14. Postdoctorates in doctorate-granting institutions employed in the biological and health sciences, by detailed field and citizenship: 1979..... 48

B-15. Employed scientists and engineers in the United States by field: 1974-78..... 50

B-16. Doctorate-granting institutions ranked by number of foreign science/engineering postdoctorates: 1979 51

B-17. Science/engineering postdoctorates in medical and graduate schools by sex, citizenship, and institutional control: 1979 . 53

B-18. Foreign as a percent of all science/engineering postdoctorates in doctorate-granting institutions by State: 1979 54

Table B-1. Number of foreign students reported in, and number of institutions responding to, IIE's Open Doors Survey: 1954/55—1979/80

Year	Students reported	Institutions responding
1954/55	34,232	1,629
1955/56	36,494	1,630
1956/57	40,666	1,734
1957/58	43,391	1,801
1958/59	47,245	1,680
1959/60	48,486	1,712
1960/61	53,107	1,666
1961/62	58,066	1,798
1962/63	64,705	1,805
1963/64	74,814	1,805
1964/65	82,045	1,859
1965/66	82,709	1,755
1966/67	100,262	1,797
1967/68	110,315	1,827
1968/69	121,362	1,846
1969/70	134,959	1,734
1970/71	144,708	1,748
1971/72	140,126	1,650
1972/73	146,097	1,508
1973/74	151,066	1,359
1974/75	154,580	1,908
1975/76	179,344	2,261
1976/77	203,068	2,524
1977/78	235,509	2,738
1978/79	263,938	2,752
1979/80	286,340	2,950

SOURCE: Institute of International Education

Table B-2. Foreign enrollment from OPEC countries for selected years: 1954/55—1979/80

Country	1954/55	1964/65	1974/75	1975/76	1976/77	1977/78	1978/79	1979/80
Total foreign enrollment	34,232	82,045	154,580	179,344	203,068	235,509	263,938	286,340
OPEC	3,161	9,280	29,700	44,810	52,040	72,550	89,120	100,360
Algeria	1	83	240	430	770	1,680	1,720	1,560
Ecuador	166	390	690	690	710	800	860	1,000
Gabon	—	3	—	—	—	—	—	—
Indonesia	153	766	1,080	1,230	1,090	1,820	2,230	2,440
Iran	997	3,719	13,780	19,900	23,310	36,220	45,340	51,310
Iraq	650	919	420	450	720	1,190	1,250	1,220
Kuwait	—	214	960	1,190	1,240	1,810	1,960	2,670
Libya	4	74	980	1,540	1,610	2,090	2,290	3,030
Nigeria	268	1,382	7,210	11,440	11,870	13,510	16,220	16,360
Qatar	—	4	120	130	200	180	330	630
Saudi Arabia	40	552	1,540	3,030	4,590	5,560	8,050	9,540
United Arab Emirates	—	1	—	100	180	270	440	740
Venezuela	882	1,173	2,680	4,680	5,750	7,420	8,430	9,860
All other countries	31,071	72,765	124,880	134,534	151,028	161,959	174,818	185,980
OPEC as a percent of World total	9.2	11.3	19.2	25.0	25.6	31.2	33.8	35.0

SOURCE: Institute of International Education

Table B-3. Foreign full-time graduate students in doctorate-granting institutions by science/engineering fields: 1974-77 and 1979

Field	Number					Average annual percent change	
	1974	1975	1976	1977	1979	1974-79	1977-79
Total, all fields	31,694	33,128	34,402	36,861	44,795	7.2	10.2
Engineering	11,004	11,864	12,298	13,310	16,179	8.0	10.3
Aeronautical	395	403	434	459	513	5.4	5.7
Agricultural	189	231	299	314	321	11.2	1.1
Biomedical	106	89	88	101	114	1.5	6.2
Chemical	1,402	1,425	1,543	1,618	1,855	5.8	7.1
Civil	1,812	1,951	1,851	2,159	2,763	8.8	13.1
Electrical	2,401	2,586	2,708	2,993	3,709	9.1	11.3
Engineering science	523	519	523	536	522	0.0	-1.3
Industrial	1,021	1,241	1,214	1,348	1,507	8.1	5.7
Mechanical	1,438	1,533	1,644	1,724	2,241	9.3	14.0
Metallurgical/materials	685	728	742	776	1,045	8.8	16.0
Mining	137	148	166	181	144	1.0	-10.8
Nuclear	304	402	386	391	467	9.0	9.3
Petroleum	163	165	235	225	250	8.9	5.4
Engineering, n.e.c.	428	433	467	485	728	11.2	22.5
Physical sciences	4,478	4,396	4,443	4,589	5,187	3.0	6.3
Astronomy	47	59	60	61	63	6.0	1.6
Chemistry	2,296	2,344	2,458	2,475	2,738	3.6	5.2
Physics	2,114	1,967	1,919	2,040	2,375	2.4	7.9
Physical sciences, n.e.c.	21	6	6	13	11	-12.1	-8.0
Environmental sciences	867	913	974	1,107	1,260	8.1	7.5
Atmospheric sciences	117	132	144	139	167	7.4	10.0
Geosciences	524	536	589	651	697	5.9	3.5
Oceanography	184	202	199	250	281	8.8	6.0
Environmental sciences, n.e.c.	42	44	42	68	135	26.3	40.9
Mathematical/computer sciences	2,520	2,721	3,053	3,263	4,253	11.0	14.2
Computer science	819	971	1,076	1,085	1,590	14.2	21.1
Mathematics and applied mathematics	1,305	1,312	1,484	1,645	2,006	9.8	12.1
Statistics	396	438	493	533	597	8.6	5.8
Life sciences	6,495	6,465	6,702	6,893	8,153	4.7	8.8
Agricultural sciences	1,746	1,921	2,029	2,046	2,241	5.1	4.7
Biological sciences	3,360	3,301	3,360	3,498	3,907	2.9	5.7
Anatomy	64	59	44	55	74	2.9	16.0
Biochemistry	464	416	390	418	420	-2.0	.2
Biology	450	521	533	532	630	7.0	8.8
Biometry/epidemiology	78	66	61	77	113	7.7	21.1
Biophysics	91	98	80	96	84	-1.6	-6.5
Botany	293	295	296	321	341	3.1	3.1
Cell biology	59	57	48	51	61	.7	9.4
Ecology	30	34	29	30	53	12.1	32.9
Entomology/parasitology	195	231	245	234	220	2.4	-3.0
Genetics	100	86	90	104	93	-1.4	-5.4
Microbiology	314	298	279	275	337	1.4	10.7
Nutrition	582	543	581	621	667	3.4	5.2
Pathology	106	96	117	115	149	7.0	13.8
Pharmacology	155	159	149	161	167	3.8	7.8
Physiology	158	114	136	118	181	2.8	23.9
Zoology	115	110	132	126	137	3.8	4.3
Biosciences, n.e.c.	125	118	150	164	140	2.3	-7.8
Health sciences	1,369	1,243	1,313	1,349	2,005	7.9	21.9
Anesthesiology	21	3	1	0	1	-45.6	0
Cardiology	4	5	0	0	0	-100.0	0
Clinical pharmacology	0	0	0	0	0	0	0
Dentistry	119	111	169	176	247	15.7	18.5
Endocrinology	5	4	5	3	1	-27.5	-42.3
Gastro-enterology	7	1	0	0	0	-100.0	0

Table B-3. Foreign full-time graduate students in doctorate-granting institutions by science/engineering fields: 1974-77 and 1979—Con.

Field	Number					Average annual percent change	
	1974	1975	1976	1977	1979	1974-79	1977-79
Hematology	2	0	0	0	0	-100.0	0
Neurology	18	12	10	12	11	-9.4	-4.3
Nursing	48	53	70	146	182	30.5	11.7
Obstetrics/gynecology	7	8	8	5	8	2.7	26.5
Ophthalmology	6	2	0	0	0	-100.0	0
Otorhinolaryngology	1	9	12	4	3	24.6	-13.4
Pediatrics	12	7	5	5	2	-30.1	-36.8
Pharmaceutical sciences	399	412	405	417	486	4.0	8.0
Preventive medicine/ community health	303	287	281	227	385	4.9	30.2
Psychiatry	11	2	4	3	8	-6.2	63.3
Pulmonary disease	10	0	0	0	0	-100.0	0
Radiology	27	27	26	25	35	5.3	18.3
Speech pathology/ audiology	64	70	80	59	126	14.5	46.1
Surgery	14	16	16	7	6	-15.6	-7.4
Veterinary sciences	107	112	128	144	209	14.3	20.5
Clinical medicine, n.e.c.	120	40	28	37	28	-25.3	-13.0
Health related, n.e.c.	64	62	85	79	267	33.1	83.8
Psychology	536	567	586	611	961	12.4	25.4
Social sciences	5,794	6,212	6,366	7,088	8,782	8.7	11.3
Agricultural economics	609	645	611	643	663	1.7	1.5
Anthropology	272	252	252	285	320	3.3	6.0
Economics (Except agricultural)	2,058	2,216	2,480	2,731	3,000	7.8	4.8
Geography	218	237	242	249	325	8.3	14.2
History and philosophy of science	20	25	24	25	30	8.4	9.5
Linguistics	392	434	456	499	692	12.0	17.8
Political science	1,092	1,272	1,185	1,398	2,034	13.2	20.6
Sociology	812	797	808	821	1,079	5.9	14.6
Sociology/anthropology	75	78	70	87	120	9.9	17.4
Social sciences, n.e.c.	246	266	238	350	519	16.1	21.8

SOURCE: National Science Foundation

Table B-4. Full-time graduate students with U.S. citizenship in doctorate-granting institutions by science/engineering fields: 1974-77 and 1979

Field	Number					Average annual percent change	
	1974	1975	1976	1977	1979	1974-79	1977-79
Total, all fields	164,212	177,694	180,327	181,584	179,262	1.8	−0.6
Engineering	22,713	25,284	24,139	23,471	23,103	.3	.8
Aeronautical	863	827	692	699	629	−6.1	−5.1
Agricultural	299	346	342	378	423	7.2	5.8
Biomedical	562	669	633	584	681	3.9	8.0
Chemical	1,916	2,165	2,194	2,398	2,496	5.4	2.0
Civil	4,054	4,640	4,231	4,061	3,723	−1.7	−4.3
Electrical	5,249	5,547	5,295	5,286	5,074	.7	−2.0
Engineering science	1,055	1,162	1,160	967	953	−2.0	.7
Industrial	2,584	3,261	2,822	2,464	2,532	.4	1.4
Mechanical	2,775	2,891	2,825	2,746	2,754	.2	.1
Metallurgical/materials	1,009	1,092	1,149	1,200	1,118	2.1	−3.5
Mining	144	202	247	269	217	8.5	−10.2
Nuclear	757	865	847	774	645	−3.2	−8.7
Petroleum	98	93	116	115	117	3.6	.9
Engineering, n.e.c.	1,348	1,524	1,586	1,530	1,741	5.2	6.7
Physical sciences	16,938	17,047	17,344	17,344	16,735	−.2	−1.8
Astronomy	517	511	465	439	446	−2.9	.8
Chemistry	9,402	9,622	9,901	10,091	10,052	1.3	−.2
Physics	6,897	6,809	6,869	6,733	6,140	−2.3	−4.5
Physical sciences, n.e.c.	122	105	89	81	97	−4.5	9.4
Environmental sciences	7,334	7,759	8,324	8,486	8,639	3.3	.9
Atmospheric sciences	730	760	744	738	650	−2.3	−6.0
Geosciences	4,736	5,060	5,433	5,541	5,775	4.0	2.1
Oceanography	1,490	1,423	1,481	1,473	1,425	−.9	−1.6
Environmental sciences, n.e.c.	378	496	666	736	789	15.9	3.5
Mathematical/computer sciences	10,889	11,118	11,236	10,519	9,706	−2.3	−3.9
Computer science	2,957	3,204	3,430	3,319	3,685	4.5	5.4
Mathematics and applied mathematics	7,082	6,932	6,825	6,258	5,204	−6.0	−8.8
Statistics	850	982	981	942	817	−.8	−6.9
Life sciences	48,155	52,771	54,947	57,245	58,383	3.9	1.0
Agricultural sciences	6,747	7,576	8,136	8,383	8,023	3.5	−2.2
Biological sciences	28,649	30,982	31,474	31,994	30,966	1.6	−1.6
Anatomy	900	941	997	1,005	968	1.5	−1.9
Biochemistry	2,969	2,957	3,024	3,097	3,079	.7	−.3
Biology	7,046	8,225	8,347	8,294	7,538	1.4	−4.7
Biometry/epidemiology	481	523	461	580	630	5.5	4.2
Biophysics	555	610	587	524	472	−3.2	−5.1
Botany	2,025	2,016	2,160	2,264	2,150	1.2	−2.6
Cell biology	402	484	456	501	599	8.3	9.3
Ecology	482	622	695	786	651	6.2	−9.0
Entomology/parasitology	992	1,142	1,165	1,143	1,241	4.6	4.2
Genetics	636	667	669	774	714	2.3	−4.0
Microbiology	3,022	3,171	3,221	3,278	3,014	−.1	−4.1
Nutrition	1,561	1,612	1,746	1,986	2,117	6.3	3.3
Pathology	733	794	803	798	859	3.2	3.8
Pharmacology	1,138	1,346	1,422	1,461	1,599	7.0	4.6
Physiology	1,807	1,960	1,824	1,829	1,737	−.8	−2.5
Zoology	2,968	2,948	2,742	2,489	2,258	−5.3	−4.8
Biosciences, n.e.c.	932	964	1,155	1,186	1,340	7.5	6.3

Table B-4. Full-time graduate students with U.S. citizenship in doctorate-granting institutions by science/engineering fields: 1974-77 and 1979—Con.

Field	Number					Average annual percent change	
	1974	1975	1976	1977	1979	1974-79	1977-79
Health sciences	12,759	14,213	15,337	16,868	19,394	8.7	7.2
Anesthesiology	38	52	4	3	17	−14.9	138.0
Cardiology	39	17	0	3	3	−40.1	0.0
Clinical pharmacology	1	3	24	5	0	−100.0	−100.0
Dentistry	740	943	821	848	937	4.8	5.1
Endocrinology	23	38	28	28	43	13.3	23.9
Gastroenterology	39	10	8	8	0	−100.0	−100.0
Hematology	20	3	3	5	7	−18.9	18.3
Neurology	120	181	150	162	162	6.2	0.0
Nursing	2,303	2,730	3,769	5,132	5,959	20.9	7.8
Obstetrics/gynecology	50	43	44	20	25	−12.9	11.8
Ophthalmology	34	22	8	8	3	−38.5	−38.8
Otorhinolaryngology	65	41	52	52	21	−20.2	−36.5
Pediatrics	107	104	112	81	86	−4.3	3.0
Pharmaceutical sciences	950	1,061	1,011	1,158	1,154	4.0	−.2
Preventive medicine/-community health	2,335	2,828	3,058	2,918	3,558	8.8	10.4
Psychiatry	194	166	138	141	156	−4.3	5.2
Pulmonary disease	37	7	0	3	1	−51.4	−42.3
Radiology	205	218	173	192	158	−5.1	−9.3
Speech pathology/-audiology	2,751	3,471	3,450	3,523	3,495	4.9	−.4
Surgery	93	98	91	76	53	−10.6	−16.5
Veterinary sciences	399	417	470	531	539	6.2	.8
Clinical medicine, n.e.c.	850	366	345	489	490	−10.4	.1
Health related, n.e.c.	1,366	1,394	1,578	1,482	2,527	13.1	30.6
Psychology	18,370	19,208	20,980	20,802	19,744	1.5	−2.6
Social sciences	39,813	44,507	43,357	43,717	42,952	1.5	−.9
Agricultural economics	1,003	1,280	1,362	1,343	1,314	5.6	−1.1
Anthropology	4,325	4,581	4,639	4,638	4,130	−.9	−5.6
Economics (except agricultural)	4,835	5,544	5,115	5,226	4,804	−.1	−4.1
Geography	1,793	1,917	1,964	1,829	1,556	−2.7	−7.8
History and philosophy of science	227	234	246	232	204	−2.1	−6.2
Linguistics	2,166	2,596	2,675	2,392	2,194	.3	−4.2
Political science	9,905	11,530	10,807	10,858	11,043	2.2	.8
Sociology	7,270	7,711	7,204	6,669	5,901	−4.1	−5.9
Sociology/anthropology	879	980	659	709	514	−10.2	−14.9
Social sciences, n.e.c.	7,420	8,134	8,686	9,821	11,292	8.8	7.2

SOURCE: National Science Foundation

Table B-5. Doctorate-granting institutions ranked by number of foreign full-time students in graduate science/engineering fields: 1979

	Institution by rank	Total	Foreign	Foreign as percent of total
	Total, all institutions	224,057	44,795	20.0
1	University of California at Berkeley	5,411	1,239	22.9
2	Massachusetts Institute of Technology	3,822	1,101	28.8
3	Ohio State University	3,787	1,002	26.5
4	University of Wisconsin-Madison	4,487	904	20.1
5	University of Michigan	4,237	874	20.6
6	University of Illinois - Urbana	3,891	864	22.2
7	Stanford University	3,213	861	26.8
8	University of California at Los Angeles	4,007	830	20.7
9	University of Southern California	3,310	774	23.4
10	Cornell University	2,811	722	25.7
	Total, 1st 10 institutions	38,976	9,171	23.5
11	University of Minnesota	4,259	714	16.8
12	Michigan State University	2,872	654	22.8
13	Purdue University	2,975	637	21.4
14	University of Texas at Austin	3,042	625	20.5
15	Iowa State University of Science and Technology	1,884	585	31.1
16	Columbia University Main Division	2,143	545	25.4
17	University of Washington	3,515	528	15.0
18	Pennsylvania State University	2,310	526	22.8
19	University of California at Davis	2,392	520	21.7
20	North Carolina State University at Raleigh	1,716	494	28.8
	Total, 1st 20 institutions	66,084	14,999	22.7
21	University of Florida	2,071	485	23.4
22	Texas A&M University	2,514	454	18.1
23	Oregon State University	1,555	449	28.9
24	University of Pittsburgh	1,692	440	26.0
25	SUNY-Buffalo	1,337	429	32.1
26	University of Pennsylvania	1,691	429	25.4
27	Harvard University	2,393	404	16.9
28	SUNY-Stony Brook	1,653	396	24.0
29	University of Oklahoma-Norman	1,138	390	34.3
30	Georgia Institute of Technology	1,393	390	28.0
	Total, 1st 30 institutions	83,521	19,265	23.1
31	University of Iowa	1,510	380	25.2
32	Northwestern University	1,318	379	28.8
33	Oklahoma State University	1,095	371	33.9
34	Kansas State University of Agriculture and Applied Science	1,029	365	35.5
35	Rensselaer Polytechnic Institute	1,094	361	33.0
36	University of Missouri-Columbia	1,570	360	22.9
37	University of Arizona	2,259	354	15.7
38	University of Cincinnati	1,353	353	26.1
39	Rutgers The State University	1,678	347	20.7
40	Boston University	1,253	342	27.3
	Total, 1st 40 institutions	97,678	22,877	23.4
41	University of Hawaii at Manoa	1,348	341	25.3
42	Indiana University-Bloomington	1,518	332	21.9
43	Virginia Polytechnic Institute and State University	1,683	319	19.0
44	University of Chicago	1,399	316	22.6
45	University of Kansas	1,666	316	19.0
46	Northeastern University	992	313	31.6
47	University of Colorado	2,466	302	12.2
48	Howard University	794	293	36.9
49	University of Houston	833	292	35.1
50	Colorado State University	1,445	292	20.2
	Total, 1st 50 institutions	111,622	25,993	23.2
	All other institutions	112,235	18,802	16.8

SOURCE: National Science Foundation

Table B-6. Research Universities I ranked on foreign full-time graduate science/engineering enrollment: 1979

Institution	Total	Foreign	Foreign as percent of total
Total, all Research Universities I	109,614	21,160	21.1
University of California-Berkeley	5,411	1,239	22.9
Massachusetts Institute of Technology	3,822	1,101	28.8
Ohio State University	3,787	1,002	26.5
University of Wisconsin-Madison	4,487	904	20.1
University of Michigan	4,237	874	20.6
University of Illinois-Urbana	3,891	864	22.2
Stanford University	3,213	861	26.8
University of California-Los Angeles	4,007	830	20.7
University of Southern California	3,310	774	23.4
Cornell University	2,811	722	25.7
University of Minnesota	4,259	714	16.8
Michigan State University	2,872	654	22.8
Purdue University	2,975	637	21.4
University of Texas-Austin	3,042	625	20.5
Columbia University-Main Division	2,143	545	25.4
University of Washington	3,515	528	15.0
Pennsylvania State University	2,310	526	22.8
University of California-Davis	2,392	520	21.7
North Carolina State University at Raleigh	1,716	494	28.8
University of Florida	2,071	485	23.4
Texas A&M University	2,514	454	18.1
Oregon State University	1,555	449	28.9
University of Pittsburgh	1,692	440	26.0
University of Pennsylvania	1,691	429	25.4
Harvard University	2,393	404	16.9
University of Iowa	1,510	380	25.2
Northwestern University	1,318	379	28.8
University of Missouri-Columbia	1,570	360	22.9
University of Arizona	2,259	354	15.7
Boston University	1,253	342	27.3
University of Hawaii-Manoa	1,348	341	25.3
University of Chicago	1,399	316	22.6
University of Colorado	2,466	302	12.2
Colorado State University	1,445	292	20.2
University of Maryland-College Park	1,396	274	19.6
Case Western Reserve University	1,262	259	20.5
New York University	1,603	250	15.6
California Institute of Technology	872	249	28.6
Yale University	1,517	244	16.1
Princeton University	1,035	235	22.7
Washington University	1,170	216	18.5
University of Utah	1,477	214	14.5
University of Georgia	1,472	202	13.7
Johns Hopkins University	1,188	182	15.3
University of Rochester	798	169	21.2
University of California-San Diego	1,056	153	14.5
University of North Carolina-Chapel Hill	2,152	132	6.1
University of Miami	603	112	18.6
Duke University	972	97	10.0
Rockefeller University	96	17	17.7
Yeshiva University	261	14	5.4

SOURCES: National Science Foundation and Carnegie Council on Policy Studies in Higher Education

Table B-7. Research Universities II ranked on foreign full-time graduate science/engineering enrollment: 1979

Institution	Total	Foreign	Foreign as percent of total
Total, all Research Universities II	49,232	10,670	21.7
Iowa State University	1,884	585	31.1
State University of New York-Buffalo	1,337	429	32.1
State University of New York-Stony Brook	1,653	396	24.0
University of Oklahoma-Norman	1,138	390	34.3
Georgia Institute of Technology	1,393	390	28.0
Oklahoma State University	1,095	371	33.9
Kansas State University	1,029	365	35.5
University of Cincinnati	1,353	353	26.1
Rutgers the State University	1,676	347	20.7
Indiana University-Bloomington	1,518	332	21.9
Virginia Polytechnic Institute	1,683	319	19.0
University of Kansas	1,666	316	19.0
Howard University	794	293	36.9
Mississippi State University	662	291	44.0
University of Tennessee-Knoxville	2,229	291	13.1
Syracuse University	1,169	290	24.8
George Washington University	675	278	41.2
Louisiana State University	1,193	276	23.1
West Virginia University	1,268	269	21.2
Washington State University	1,248	261	20.9
University of Nebraska-Lincoln	985	257	26.1
Wayne State University	1,385	254	18.3
City University of New York Graduate School	1,590	248	15.6
University of Connecticut	1,512	234	15.5
University of Massachusetts-Amherst	1,687	227	13.5
Georgetown University	824	223	27.1
Auburn University	847	200	23.6
University of Kentucky	1,281	194	15.1
Carnegie-Mellon University	674	178	26.4
Utah State University	634	176	27.8
Tulane University of Louisiana	631	157	24.9
University of Oregon	668	145	21.7
Brown University	564	145	25.7
University of New Mexico	865	144	16.6
Florida State University	1,330	142	10.7
University of Arkansas	685	138	20.1
Vanderbilt University	603	127	21.1
Catholic University of America	712	108	15.2
University of Virginia	1,232	99	8.0
Temple University	967	90	9.3
University of California-Irvine	910	88	9.7
Brandeis University	323	76	23.5
Tufts University	391	46	11.8
Saint Louis University	495	44	8.9
Claremont University Center and Graduate School	146	38	26.0
Emory University	343	29	8.5
University of Vermont	305	21	6.9

SOURCES: National Science Foundation and Carnegie Council on Policy Studies in Higher Education

Table B-8. Foreign full-time science/engineering students in doctorate-granting institutions by geographic distribution: 1974-77 and 1979

Division and State	Number					Average annual percent change		
	1974	1975	1976	1977	1979	1974-79	1974-77	1977-79
Total, all States	31,694	33,128	34,402	36,861	44,795	7.2	5.2	10.2
New England	2,779	2,807	2,836	3,010	3,641	5.6	2.7	10.0
Connecticut	371	371	401	435	488	5.6	5.4	5.9
Maine	38	30	24	25	28	−4.4	−10.6	5.8
Massachusetts	2,045	2,101	2,123	2,258	2,787	6.4	3.4	11.1
New Hampshire	43	38	38	40	42	−.5	−2.4	2.5
Rhode Island	263	249	230	233	273	.7	−4	8.2
Vermont	22	18	19	19	23	.9	−4	10.0
Middle Atlantic	5,642	5,429	5,349	5,692	7,020	4.5	.3	11.1
New Jersey	630	662	590	644	834	5.8	.7	13.8
New York	3,602	3,356	3,249	3,397	4,215	3.2	−1.9	11.4
Pennsylvania	1,410	1,411	1,510	1,651	1,971	6.9	5.4	9.3
East North Central	6,708	7,029	7,226	7,592	9,245	6.6	4.2	10.4
Illinois	1,787	1,962	1,943	2,029	2,425	6.3	4.3	9.3
Indiana	869	875	897	976	1,193	6.5	3.9	10.6
Michigan	1,670	1,632	1,772	1,827	2,100	4.7	3.0	7.2
Ohio	1,469	1,545	1,686	1,719	2,441	10.7	5.4	19.2
Wisconsin	913	1,015	928	1,041	1,086	3.5	4.5	2.1
West North Central	2,519	2,757	3,063	3,212	3,720	8.1	8.4	7.6
Iowa	399	552	677	760	970	19.4	24.0	13.0
Kansas	500	557	631	701	743	8.2	11.9	3.0
Minnesota	694	728	706	602	714	.6	−4.6	8.9
Missouri	583	596	663	700	793	6.3	6.3	6.4
Nebraska	194	188	229	281	292	8.5	13.1	1.9
North Dakota	83	77	105	97	109	5.6	5.3	6.0
South Dakota	66	59	52	71	99	8.4	2.5	18.1
South Atlantic	3,269	3,553	3,733	4,091	5,025	9.0	7.8	10.8
Delaware	53	59	64	66	113	16.3	7.6	30.8
District of Columbia	441	694	823	1,039	1,060	19.2	33.1	1.0
Florida	627	621	706	675	873	6.8	2.5	13.7
Georgia	556	542	498	520	730	5.6	−2.2	18.5
Maryland	519	504	399	404	501	−.7	−8.0	11.4
North Carolina	544	546	576	609	740	6.3	3.8	10.2
South Carolina	125	117	137	195	212	11.1	16.0	4.3
Virginia	239	307	329	347	509	16.3	13.2	21.1
West Virginia	165	163	201	236	287	11.7	12.7	10.3
East South Central	975	1,056	1,177	1,266	1,597	10.4	9.1	12.3
Alabama	140	170	221	258	387	22.6	22.6	22.5
Kentucky	229	264	294	260	261	2.7	4.3	.2
Mississippi	189	218	260	298	408	16.6	16.4	17.0
Tennessee	417	404	402	450	541	5.3	2.6	9.6
West South Central	2,484	2,770	2,940	3,285	4,284	11.5	9.8	14.2
Arkansas	53	70	92	112	147	22.6	28.3	14.6
Louisiana	309	288	287	349	581	13.5	4.1	29.0
Oklahoma	600	676	694	742	871	7.7	7.3	8.3
Texas	1,522	1,736	1,867	2,082	2,685	12.0	11.0	13.6

Table B-8. Foreign full-time science/engineering students in doctorate-granting institutions by geographic distribution: 1974-77 and 1979—Con.

Division and State	Number					Average annual percent change		
	1974	1975	1976	1977	1979	1974-79	1974-77	1977-79
Mountain	1,684	1,703	1,786	1,982	2,406	7.4	5.6	10.2
Arizona	317	338	340	424	477	8.5	10.2	6.1
Colorado	555	560	619	733	848	8.8	9.7	7.6
Idaho	63	56	76	92	90	7.4	13.5	−1.1
Montana	44	26	24	16	28	−8.6	−28.6	32.3
Nevada	48	37	36	44	51	1.2	−2.9	7.7
New Mexico	184	193	176	151	308	10.9	−6.4	42.8
Utah	419	426	421	441	479	2.7	1.7	4.2
Wyoming	54	67	74	81	124	18.1	14.5	23.7
Pacific	5,479	5,870	6,182	6,622	7,607	7.3	6.5	8.6
Alaska	12	5	10	12	14	3.1	0.0	8.0
California	4,232	4,636	4,791	4,966	5,991	7.2	5.6	9.6
Hawaii	304	306	343	342	341	2.3	4.0	−.1
Oregon	426	423	469	581	672	9.5	10.9	7.5
Washington	505	500	569	701	789	9.3	11.6	6.1
Outlying Areas	155	154	131	109	51	19.9	−11.1	−31.6

SOURCE: National Science Foundation

Table B-9. Foreign full-time graduate students in master's-granting institutions by science/engineering field: 1977 and 1979

Field	Number		Average annual percent change
	1977	1979	1977-79
Total, all fields	1,596	2,183	16.9
Engineering	337	526	24.9
Aeronautical	3	1	-42.3
Agricultural	4	1	-50.0
Biomedical	0	0	0
Chemical	18	30	29.1
Civil	33	67	42.5
Electrical	89	132	21.8
Engineering Science	4	4	0.0
Industrial	56	30	-26.8
Mechanical	32	44	17.3
Metallurgical/-materials	2	5	58.1
Mining	0	0	0
Nuclear	4	0	-100.0
Petroleum	0	1	0
Engineering, n.e.c.	92	211	51.4
Physical sciences	124	166	15.7
Astronomy	0	0	0
Chemistry	101	118	8.1
Physics	19	48	58.9
Physical sciences, n.e.c.	4	0	-100.0
Environmental sciences	37	44	9.0
Atmospheric sciences	0	0	0
Geosciences	10	18	34.2
Oceanography	0	0	0
Environmental sciences, n.e.c.	27	26	-1.9
Mathematical/computer sciences	161	292	34.7
Computer science	87	195	49.7
Mathematics and applied mathematics	72	95	14.9
Statistics	2	2	0.0
Life sciences	284	474	29.2
Agricultural sciences	77	165	46.4
Biological sciences	168	223	15.2
Anatomy	0	0	0
Biochemistry	13	2	-60.8
Biology	123	192	24.9
Biometry/-epidemiology	0	0	0
Biophysics	0	0	0
Botany	0	0	0
Cell biology	0	0	0
Ecology	0	0	0
Entomology/parasitology	0	0	0
Genetics	2	0	-100.0
Microbiology	13	10	-12.3
Nutrition	13	11	-8.0
Pathology	0	0	0
Pharmacology	2	3	22.5
Physiology	0	0	0
Zoology	2	0	-100.0
Biosciences, n.e.c.	0	5	0
Health sciences	39	86	48.5
Anesthesiology	0	0	0
Cardiology	0	0	0
Clinical pharmacology	0	0	0
Dentistry	0	0	0
Endocrinology	0	0	0
Gastroenterology	0	0	0
Hematology	0	0	0
Neurology	0	0	0
Nursing	1	4	100.0
Obstetrics/-Gynecology	0	0	0
Ophthalmology	2	0	-100.0
Otorhino-laryngology	0	0	0
Pediatrics	0	0	0
Pharmaceutical sciences	0	0	0
Preventive medicine/-community health	4	9	50.0
Psychiatry	0	0	0
Pulmonary disease	0	0	0
Radiology	0	0	0
Speech pathology/-audiology	7	18	60.4
Surgery	0	0	0
Veterinary sciences	3	2	-18.4
Clinical medicine, n.e.c.	6	0	-100.0
Health related, n.e.c.	16	53	82.0
Psychology	117	182	24.7
Social sciences	538	499	-3.7
Agricultural economics	13	10	-12.3
Anthropology	5	13	61.2
Economics (except agricultural)	150	113	-13.2
Geography	11	16	20.6
History and philosophy of science	0	0	0
Linguistics	10	7	-16.3
Political science	222	184	-9.0
Sociology	74	72	-1.4
Sociology/-anthropology	1	2	41.4
Social sciences, n.e.c.	52	82	25.6

Source: National Science Foundation

Table B-10. Master's-granting institutions ranked by number of foreign full-time students in graduate science/engineering fields: 1979

	Institution by rank	Total	Foreign	Foreign as percent of total
	Total, all institutions	19,274	2,183	11.3
1	West Coast University	386	101	26.2
2	Alabama A&M University	92	64	69.6
3	Loyola Marymount University	190	61	32.1
4	Texas A&I University	107	60	56.1
5	University of Bridgeport	112	58	51.8
6	Manhattan College	81	50	61.7
7	San Jose State University	494	49	9.9
8	San Francisco State University	652	48	7.4
9	California State Polytechnic University at Pomona	139	47	33.8
10	California State University at Los Angeles	366	46	12.6
	Total, 1st 10 institutions	2,619	584	22.3
11	California State University at Fullerton	175	44	25.1
12	California State University at Chico	335	44	13.1
13	Texas Southern University	109	42	38.5
14	California State University at Sacramento	482	41	8.5
15	Mankato State University	229	40	17.5
16	Tennessee State University	113	38	33.6
17	CUNY Hunter College	593	35	5.9
18	Roosevelt University	198	35	17.7
19	Antioch University	497	34	6.8
20	Western Illinois University	172	33	19.2
	Total, 1st 20 institutions	5,522	970	17.6
21	California State University at Long Beach	184	32	17.4
22	Eastern New Mexico University	158	31	19.6
23	Middle Tennessee State University	123	31	25.2
24	California State University at Northridge	407	30	7.4
25	Seattle University	78	30	38.5
26	California Poly State University at San Luis Obispo	109	29	26.6
27	Tuskegee Institute	73	29	39.7
28	CUNY City College	155	28	18.1
29	California State University at Dominguez Hills	331	28	8.5
30	University of Houston at Clear Lake City	248	24	9.7
	Total, 1st 30 institutions	7,388	1,262	17.1
31	Williams College	22	22	100.0
32	Central Missouri State University	142	22	15.5
33	Southern Illinois University at Edwardsville	166	21	12.7
34	University of Wisconsin-Stout	228	21	9.2
35	University of Texas at San Antonio	148	20	13.5
36	Youngstown State University	55	20	36.4
37	University of Wisconsin-Stevens Point	100	20	20.0
38	Pacific States University	20	20	100.0
39	University of Hartford	131	20	15.3
40	Jackson State University	112	18	16.1
	Total, 1st institutions	8,512	1,466	17.2
41	Northrop University	20	18	90.0
42	Sangamon State Unversity	130	18	13.8
43	Pittsburg State University	92	17	18.5
44	California State University at Fresno	181	16	8.8
45	North Carolina A&T State University	31	15	48.4
46	Eastern Washington University	247	15	6.1
47	University of Central Florida	177	15	8.5
48	Western Washington University	167	14	8.4
49	University of Portland	14	13	92.9
50	Emporia State University-Kansas	143	13	9.1
	Total, 1st 50 institutions	9,714	1,620	16.7
	All other institutions	9,560	563	5.9

SOURCE: National Science Foundation

Table B-11. Number of Ph.D. recipients in science/engineering by field and type of citizenship: 1960-79

Year	Total	U.S.	Foreign			Citizenship not known
			Total	Immigrants	Non-immigrants	
All science/engineering fields						
1960	6,316	5,301	966	223	743	49
1961	6,757	5,632	1,032	182	850	93
1962	7,493	6,231	1,174	138	1,036	88
1963	8,279	6,884	1,258	234	1,024	137
1964	9,297	7,625	1,488	294	1,194	184
1965	10,542	8,590	1,797	357	1,440	155
1966	11,537	9,263	1,978	369	1,609	296
1967	13,065	10,561	2,253	568	1,685	251
1968	14,526	11,806	2,489	678	1,811	229
1969	16,075	13,080	2,721	842	1,879	274
1970	17,840	14,494	3,165	1,136	2,029	181
1971	19,078	15,300	3,514	1,411	2,103	264
1972	19,127	15,005	3,812	1,632	2,180	310
1973	19,121	14,788	4,004	1,565	2,439	329
1974	18,460	13,560	4,050	1,388	2,662	850
1975	18,488	14,107	4,015	1,257	2,758	366
1976	18,089	13,922	3,801	1,088	2,713	366
1977	17,841	13,538	3,809	982	2,827	494
1978	17,034	13,009	3,472	970	2,502	553
1979	17,230	13,195	3,526	924	2,602	509
Physical sciences						
1960	1,861	1,619	229	51	178	13
1961	1,993	1,696	269	48	221	28
1962	2,097	1,812	262	32	230	23
1963	2,428	2,045	333	55	278	50
1964	2,527	2,130	343	74	269	54
1965	2,865	2,418	411	85	326	36
1966	3,050	2,526	446	88	358	87
1967	3,504	2,891	540	124	416	73
1968	3,671	3,073	527	130	397	71
1969	3,919	3,251	581	170	411	87
1970	4,404	3,631	709	275	434	64
1971	4,501	3,689	737	330	407	75
1972	4,233	3,348	819	373	446	66
1973	4,021	3,098	856	348	508	67
1974	3,709	2,743	809	302	507	157
1975	3,631	2,734	813	269	544	84
1976	3,442	2,619	765	247	518	58
1977	3,410	2,623	720	213	507	67
1978	3,234	2,494	670	206	464	70
1979	3,321	2,570	685	199	486	66
Mathematical sciences						
1960	291	233	55	11	44	3
1961	332	272	51	7	44	9
1962	388	312	72	7	65	4
1963	483	401	72	11	61	10
1964	568	489	89	9	80	10
1965	685	578	92	16	76	15
1966	769	634	119	22	97	16
1967	830	692	119	27	92	19
1968	970	798	154	42	112	18
1969	1,065	887	163	49	114	15
1970	1,224	1,018	191	57	134	15
1971	1,238	1,012	214	62	152	12
1972	1,281	1,030	234	65	169	17
1973	1,232	951	254	81	173	27
1974	1,208	873	295	71	224	40
1975	1,147	848	272	75	197	27
1976	1,003	748	238	55	183	17
1977	959	710	224	54	170	25
1978	959	704	233	52	181	22
1979	977	712	244	63	181	21

Table B-11. Number of Ph.D. recipients in science/engineering by field and type of citizenship: 1960-79

Year	Total	U.S.	Foreign			Citizenship not known
			Total	Immigrants	Non-immigrants	
Engineering						
1960	794	607	183	54	129	4
1961	940	732	202	48	154	6
1962	1,216	949	259	41	218	8
1963	1,357	1,062	280	65	215	15
1964	1,664	1,313	331	84	247	20
1965	2,074	1,603	430	111	319	41
1966	2,301	1,718	501	116	385	82
1967	2,604	1,957	607	198	409	40
1968	2,848	2,134	680	244	436	34
1969	3,251	2,416	780	320	460	55
1970	3,433	2,542	872	401	471	19
1971	3,500	2,436	1,032	513	519	32
1972	3,476	2,307	1,137	619	518	32
1973	3,339	2,126	1,170	552	618	43
1974	3,121	1,735	1,208	507	701	178
1975	2,961	1,685	1,223	413	810	53
1976	2,791	1,532	1,183	384	799	76
1977	2,641	1,468	1,098	325	773	75
1978	2,423	1,259	1,092	325	767	72
1979	2,494	1,294	1,138	322	816	62
Life sciences (excl. Ag.)						
1960	1,246	1,048	188	40	148	10
1961	1,244	1,020	208	35	173	16
1962	1,397	1,167	215	14	201	15
1963	1,510	1,252	246	37	209	12
1964	1,702	1,376	293	43	250	33
1965	1,963	1,583	360	53	307	20
1966	2,135	1,740	365	52	313	30
1967	2,361	1,947	378	80	298	36
1968	2,822	2,324	470	111	359	28
1969	3,084	2,586	463	123	340	35
1970	3,359	2,813	522	161	361	24
1971	3,652	3,063	511	199	312	78
1972	3,663	3,049	535	225	310	79
1973	3,731	3,085	570	251	319	76
1974	3,585	2,829	587	217	370	169
1975	3,636	3,024	532	202	330	80
1976	3,692	3,090	500	170	330	102
1977	3,484	2,909	479	160	319	96
1978	3,508	2,988	432	142	290	88
1979	3,640	3,119	429	132	297	92

Table B-11. Number of Ph.D. recipients in science/engineering by field and type of citizenship: 1960-79—Con.

Year	Total	U.S.	Foreign			Citizenship not known
			Total	Immigrants	Non-immigrants	
Agricultural sciences						
1960	414	306	107	16	91	1
1961	438	338	98	6	92	2
1962	470	344	126	14	112	—
1963	466	365	97	7	90	4
1964	517	366	149	14	135	2
1965	576	380	189	17	172	7
1966	576	379	186	11	175	11
1967	606	408	195	13	182	3
1968	681	450	225	29	196	6
1969	720	488	229	28	201	3
1970	804	564	237	38	199	3
1971	902	597	302	65	237	3
1972	853	533	316	85	231	4
1973	853	542	308	75	233	3
1974	820	461	336	65	271	23
1975	904	563	336	70	266	5
1976	788	499	281	37	244	8
1977	782	488	283	27	256	11
1978	853	531	310	43	267	12
1979	855	543	294	29	265	18
Social sciences						
1960	1,710	1,488	204	51	153	18
1961	1,810	1,574	204	38	166	32
1962	1,925	1,647	240	30	210	38
1963	2,035	1,759	230	59	171	46
1964	2,299	1,951	283	70	213	65
1965	2,379	2,028	315	75	240	36
1966	2,697	2,266	361	80	281	70
1967	3,160	2,666	414	126	288	80
1968	3,534	3,029	433	122	311	72
1969	4,036	3,452	505	152	353	79
1970	4,616	3,926	634	204	430	56
1971	5,285	4,503	718	242	476	64
1972	5,621	4,738	771	265	506	112
1973	5,945	4,986	846	258	588	113
1974	6,017	4,919	815	226	589	283
1975	6,209	5,253	839	228	611	117
1976	6,373	5,434	834	195	639	105
1977	6,365	5,340	805	203	602	220
1978	6,057	5,033	735	202	533	289
1979	5,943	4,957	736	179	557	250

Note: Differences in data for 1970 between tables B-11 and B-12 are attributable to two factors: (1) Reclassification of persons who had applications pending for U.S. citizenship, and (2) differences in selection of five fields to be included as social sciences.

SOURCE: National Science Foundation

Table B-12. Number of foreign Ph.D. recipients in science and engineering, immigrant and nonimmigrant, and postgraduation plans: 1970 and 1979

Field	1970					
		Definite plans				
	Total	Total	Study in U.S.	Work in U.S.	Other	No definite plans
Total immigrant and nonimmigrant						
Total S/E fields	3,161	2,059	478	715	866	1,102
Physical sciences	730	472	202	127	143	258
Mathematical sciences	192	122	11	65	46	70
Engineering	901	500	59	272	169	401
Life sciences (excl. Ag.)	532	373	159	62	152	159
Agriculture	246	165	24	17	124	81
Social sciences	560	427	23	172	232	133
Immigrant (Permanent)						
Total S/E fields	1,191	726	185	441	100	465
Physical sciences	296	171	75	79	17	125
Mathematical sciences	58	38	2	30	6	20
Engineering	430	229	24	176	29	201
Life sciences (excl. Ag.)	171	118	65	39	14	53
Agricultural sci.	47	25	4	13	8	22
Social sciences	189	145	15	104	26	44
Nonimmigrant (Temporary)						
Total S/E fields	1,970	1,333	293	274	766	637
Physical sciences	434	301	127	48	126	133
Mathematical sciences	134	84	9	35	40	50
Engineering	471	271	35	96	140	200
Life sciences (excl. Ag.)	361	255	94	23	138	106
Agricultural sci.	199	140	20	4	116	59
Social sciences	371	282	8	68	206	89

Table B-12. Number of foreign Ph.D. recipients in science and engineering, immigrant and nonimmigrant, and postgraduation plans: 1970 and 1979—Con.

Field	1979					
		Definite plans				
	Total	Total	Study in U.S.	Work in U.S.	Other	No definite plans
Total Immigrant and Nonimmigrant						
Total S/E fields	3,526	2,331	529	769	1,033	1,195
Physical sciences	685	471	220	92	159	214
Mathematical sciences	244	150	14	83	53	94
Engineering	1,138	749	110	399	240	389
Life sciences (excl. Ag.)	429	296	146	22	128	133
Agriculture	294	183	17	11	155	111
Social sciences	736	482	22	162	298	254
Immigrant (Permanent)						
Total S/E fields	924	599	147	388	64	325
Physical sciences	199	122	49	58	15	77
Mathematical sciences	63	40	4	33	3	23
Engineering	322	223	18	192	13	99
Life sciences (excl. Ag.)	132	89	63	15	11	43
Agricultural sciences	29	13	3	7	3	16
Social sciences	179	112	10	83	19	67
Nonimmigrant (Temporary)						
Total S/E fields	2,602	1,732	382	381	969	870
Physical sciences	486	349	171	34	144	137
Mathematical sciences	181	110	10	50	50	71
Engineering	816	526	92	207	227	290
Life sciences (excl. Ag.)	297	207	83	7	117	90
Agricultural sciences	265	170	14	4	152	95
Social sciences	557	370	12	79	279	187

Note: Differences in data for 1970 between tables B-11 and B-12 are attributable to two factors: (1) Reclassification of persons who had application pending for U.S. citizenship, and (2) differences in selection of five fields to be included as social sciences.

SOURCE: National Science Foundation

Table B-13. Foreign science/engineering postdoctorates in doctorate-granting institutions by field: 1977 and 1979

Field	Number		Percent change
	1977	1979	1977-79
Total, all fields	6,201	6,075	-2.0
Engineering	648	663	2.3
Aeronautical	30	19	-36.7
Agricultural	11	11	—
Biomedical	9	7	-22.2
Chemical	142	139	-2.1
Civil	83	65	-21.7
Electrical	71	72	1.4
Engineering science	46	46	—
Industrial	7	6	-14.3
Mechanical	72	74	2.8
Metallurgical/materials	139	174	25.2
Mining	8	6	-25.0
Nuclear	7	16	128.6
Petroleum	3	4	-33.3
Engineering, n.e.c.	20	24	20.0
Physical sciences	1,728	1,992	15.3
Astronomy	29	33	13.8
Chemistry	1,229	1,405	14.3
Physics	470	554	17.9
Physical sciences, n.e.c.	0	0	0
Environmental sciences	111	112	.9
Atmospheric sciences	12	26	116.7
Geosciences	82	72	12.2
Oceanography	12	13	8.3
Environmental sciences, n.e.c.	5	1	-80.0
Mathematical and computer sciences	51	94	84.3
Computer science	12	13	8.3
Mathematics and applied mathematics	29	71	144.8
Statistics	10	10	—
Life sciences	3,526	3,079	12.7
Agricultural sciences	95	83	12.6
Biological sciences	1,931	1,872	3.1
Anatomy	54	52	3.7
Biochemistry	517	514	-.6
Biology	280	228	-18.6
Biometry/epidemiology	16	11	-31.3
Biophysics	83	30	-63.9
Botany	52	44	-15.4
Cell biology	61	73	19.7
Ecology	1	1	—

Table B-13. Foreign science/engineering postdoctorates in doctorate-granting institutions by field: 1977 and 1979—Con.

Field	Number		Percent change
	1977	1979	1977-79
Entomology/parasitology	38	28	-26.3
Genetics	45	65	44.4
Microbiology	210	218	3.8
Nutrition	49	43	-12.2
Pathology	120	128	6.7
Pharmacology	206	185	10.2
Physiology	145	171	17.9
Zoology	28	44	57.1
Biosciences, n.e.c.	26	37	42.3
Health sciences	1,500	1,124	25.1
Anesthesiology	19	13	-31.6
Cardiology	98	61	-37.8
Clinical pharmacology	19	12	-36.8
Dentistry	70	39	-44.3
Endocrinology	60	23	-61.7
Gastroenterology	33	27	-18.2
Hematology	51	16	-68.6
Neurology	50	69	38.0
Nursing	0	0	0
Obstetrics/gynecology	66	65	-1.5
Ophthalmology	54	18	-66.7
Otorhinolaryngology	8	9	12.5
Pediatrics	148	106	-28.4
Pharmaceutical sciences	131	131	—
Preventive medicine/ community health	13	24	84.6
Psychiatry	35	28	-20.0
Pulmonary disease	38	21	44.7
Radiology	63	35	-44.4
Speech pathology/audiology	2	1	-50.0
Surgery	155	96	-38.1
Veterinary sciences	26	6	-76.9
Clinical medicine, n.e.c.	352	285	-19.0
Health related, n.e.c.	9	39	333.3
Psychology	38	34	-10.5
Social sciences	99	101	2.0
Agricultural economics	4	4	—
Anthropology	7	7	—
Economics (except agricultural)	36	48	33.3
Geography	7	3	-57.1
History and philosophy of science	7	4	-42.9
Linguistics	14	20	42.9
Political science	10	4	-60.0
Sociology	10	10	—
Sociology/anthropology	0	0	0
Social sciences, n.e.c.	4	1	-75.0

SOURCE: National Science Foundation

Table B-14. Postdoctorates in doctorate-granting institutions employed in the biological and health sciences, by detailed field and citizenship: 1979

Field of science	Postdoctorates		
	Total	For-eign	U.S. citizens
Total	18,589	6,075	12,514
Biological sciences, total	6,719	1,872	4,847
Basic medical sciences, total	4,506	1,298	3,208
Anatomy	265	52	213
Biochemistry	1,503	514	989
Biophysics	139	30	109
Microbiology	847	218	738
Pathology	498	128	370
Pharmacology	582	185	397
Physiology	672	171	501
Other biosciences, total	2,213	574	1,639
Biology	928	228	700
Biometry/ epidemiology	38	11	27
Botany	137	44	93
Cell biology	283	73	210
Ecology	11	1	10
Entomology/ parasitology	104	28	76
Genetics	222	65	157
Nutrition	170	43	127
Zoology	175	44	131
Biosciences, n.e.c.	145	37	108
Health sciences, total	5,131	1,124	4,007
Clinical Medicine, total	4,548	908	3,640
Neurology	270	69	201
Preventive medicine/ community health	167	24	143
Clinical medicine, other	4,111	815	3,296
Anesthesiology	58	13	45
Cardiology	295	61	234
Clinical pharmacology	43	12	31
Endocrinology	142	23	119
Gastroenterology	103	27	76

Table B-14. Postdoctorates in doctorate-granting institutions employed in the biological and health sciences, by detailed field and citizenship: 1979—Con.

Field of science	Postdoctorates		
	Total	For-eign	U.S. citizens
Hematology	151	16	135
Obstetrics/ gynecology	164	65	99
Ophthalmology	148	18	130
Otorhinolaryng-ology	42	9	33
Pediatrics	624	106	518
Psychiatry	320	28	292
Pulmonary disease	146	21	125
Radiology	113	35	78
Surgery	301	96	205
Clinical medicine, n.e.c.	1,461	285	1,176
Other health related, total	583	216	367
Dentistry	139	39	100
Nursing	7	0	7
Pharmaceutical sciences	241	131	110
Veterinary sciences	25	6	19
Speech pathology/ audiology	26	1	25
Health related, n.e.c.	145	39	106
All other fields	6,739	3,079	3,660

SOURCE: National Science Foundation

Table B-15. Employed scientists and engineers in the United States by field: 1974-78

Field	Number			Percent change		
	1974	1976	1978	1974-76	1976-78	1974-78
Total	2,248,200	2,377,200	2,473,200	5.7	4.0	10.0
Physical scientists	201,400	227,400	212,400	12.9	−6.6	5.5
Mathematical scientists	82,800	88,300	88,400	6.6	.1	6.8
Computer specialists	166,200	172,300	233,900	3.7	35.8	40.7
Environmental scientists	69,100	74,800	72,300	8.2	−3.3	4.6
Engineers	1,212,600	1,240,700	1,268,400	2.3	2.2	4.6
Life scientists	238,600	277,500	291,000	16.3	4.9	22.0
Biological	108,300	118,700	130,600	9.6	10.0	20.6
Agricultural	88,500	114,300	118,000	29.2	3.2	33.3
Medical	41,800	44,500	42,400	6.5	4.7	1.4
Psychologists	89,600	97,800	120,900	9.2	23.6	34.9
Social scientists	187,900	196,300	186,000	5.5	−6.2	−1.0

SOURCE: National Science Foundation

Table B-16. Doctorate-granting institutions ranked by number of foreign science/engineering (S/E) postdoctorates: 1979

	Institution by rank	Foreign S/E post-doctorates	Total S/E post-doctorates	Foreign full-time S/E graduate students	R&D expenditures (in thousands)
	Total, all institutions	6,075	18,589	44,795	$5,182,729
1	Harvard University	297	1,037	404	89,008[1]
2	University of California at Berkeley	189	415	1,239	75,344
3	Stanford University	171	486	861	101,681
4	Massachusetts Institute of Technology	160	448	1,101	141,596
5	University of Wisconsin at Madison	158	434	904	122,239
6	University of California at Los Angeles	145	404	830	75,496
7	University of Southern California	143	309	774	59,077
8	Cornell University	139	367	722	100,295
9	University of California at San Francisco	127	581	56	61,140
10	Yale University	120	441	244	62,428
	Total, 1st 10	1,649	4,922	7,135	888,304
11	Purdue University	107	173	637	55,101
12	University of California at San Diego	105	329	153	107,750
13	Johns Hopkins University	101	345	182	75,592
14	Columbia Univ-Main Division	96	335	545	82,831
15	University of Minnesota	96	309	714	106,077
16	University of Illinois at Urbana	95	216	864	75,972
17	Ohio State University	95	204	1,002	62,747
18	California Institute of Technology	93	189	249	36,996
19	University of Texas at Austin	86	158	625	89,695
20	Washington University	85	306	216	53,551
	Total, 1st 20	2,606	7,486	12,322	1,614,616
21	University of Pennsylvania	85	367	429	81,961
22	Princeton University	79	185	235	26,121
23	Rockefeller University	79	212	17	35,743
24	Northwestern University	75	146	379	36,951
25	University of Chicago	68	219	316	58,917
26	University of Washington	66	357	528	98,167
27	Case Western Reserve University	62	188	259	35,535
28	Texas A&M University	59	101	454	63,271
29	Yeshiva University	58	163	2	35,093
30	University of Michigan	57	166	874	107,035
	Total, 1st 30	3,296	9,590	15,815	2,194,110

Table B-16. Doctorate-granting institutions ranked by number of foreign science/engineering (S/E) postdoctorates: 1979—Con.

Institution by rank	Foreign S/E post-doctorates	Total S/E post-doctorates	Foreign full-time S/E graduate students	R&D expenditures (in thousands)
31 University of Utah	52	105	214	35,865
32 University of California at Davis	51	133	520	55,799
33 University of Texas Hlth Sci Ctr at Dallas	48	140	23	22,613
34 Vanderbilt University	48	158	127	18,019
35 University of Arizona	47	171	354	58,140
36 University of Florida	47	124	485	48,850
37 SUNY-Stony Brook	46	148	396	23,500
38 Temple University	46	103	90	17,340
39 University of Rochester	46	167	148	60,067
40 SUNY-Buffalo	46	103	429	22,020
Total, 1st 40	3,773	10,942	18,601	2,556,323
41 University of Pittsburgh	45	116	440	30,001
42 Carnegie-Mellon University	44	72	178	24,779
43 The University of Alabama in Birmingham	42	164	75	27,089
44 Michigan State University	42	129	654	62,666
45 New York University	41	153	250	54,163
46 University of North Carolina at Chapel Hill	40	198	132	33,501
47 University of Tennessee at Knoxville	40	108	291	12,742
48 University of Iowa	39	187	380	31,393
49 University of California at Irvine	37	120	88	17,759
50 Duke University	37	284	97	36,985
Total, 1st 50	4,180	12,473	21,186	2,887,401
Total, all other institutions	1,895	6,116	23,609	$2,295,328

[1] Estimated.
SOURCE: National Science Foundation

Table B-17. Science/engineering postdoctorates in medical and graduate schools by sex, citizenship and institutional control: 1979

Sex and institutional control	Total			Medical schools			Graduate schools		
	Total	Foreign	U.S. citizens	Total	Foreign	U.S. citizens	Total	Foreign	U.S. citizens
All institutions									
Total	18,589	6,075	12,514	8,495	2,034	6,461	10,094	4,041	6,053
Men	15,210	5,391	9,819	6,804	1,731	5,073	8,406	3,660	4,746
Women	3,379	684	2,695	1,691	303	1,388	1,688	381	1,307
Public institutions									
Total	10,268	3,438	6,830	4,286	992	3,294	5,982	2,446	3,536
Men	8,571	3,077	5,494	3,522	828	2,694	5,049	2,249	2,800
Women	1,697	361	1,336	764	164	600	933	197	736
Private institutions									
Total	8,321	2,637	5,684	4,209	1,042	3,167	4,112	1,595	2,517
Men	6,639	2,314	4,325	3,282	885	2,397	3,357	1,429	1,928
Women	1,682	323	1,359	927	157	770	755	166	589

SOURCE: National Science Foundation

Table B-18. Foreign as a percent of all science/engineering postdoctorates in doctorate-granting institutions by State: 1979

Division and State	Total	Foreign	Foreign as percent of total
Total, all institutions	18,589	6,075	32.7
New England	2,654	789	29.7
Connecticut	543	158	28.7
Maine	9	4	44.4
Massachusetts	1,928	583	30.2
New Hampshire	34	6	17.6
Rhode Island	85	33	38.8
Vermont	55	7	12.7
Middle Atlantic	3,453	1,176	34.1
New Jersey	312	126	40.4
New York	2,291	760	33.2
Pennsylvania	850	290	34.1
East North Central	2,528	984	38.9
Illinois	804	315	39.2
Indiana	387	155	40.1
Michigan	370	128	34.6
Ohio	493	208	42.2
Wisconsin	474	178	37.6
West North Central	1,242	331	26.7
Iowa	262	40	15.3
Kansas	159	35	22.0
Minnesota	311	96	31.1
Missouri	424	129	30.4
Nebraska	70	26	37.1
North Dakota	17	5	29.4
South Dakota	1	0	—
South Atlantic	2,045	619	30.3
Delaware	48	22	45.8
District of Columbia	107	39	36.4
Florida	247	93	37.7
Georgia	183	79	43.2
Maryland	502	160	31.9
North Carolina	578	112	19.4
South Carolina	95	35	36.8
Virginia	253	66	26.1
West Virginia	34	13	38.2

Table B-18. Foreign as a percent of all science/engineering postdoctorates in doctorate-granting institutions by State: 1979 (Con.)

Division and State	Total	Foreign	Foreign as percent of total
East South Central	869	227	26.1
Alabama	222	71	32.0
Kentucky	90	44	48.9
Mississippi	244	12	4.9
Tennessee	313	100	31.9
West South Central	1,308	498	38.1
Arkansas	15	5	33.3
Louisiana	142	57	40.1
Oklahoma	76	33	43.4
Texas	1,075	403	37.5
Mountain	728	210	28.8
Arizona	202	65	32.2
Colorado	282	60	21.3
Idaho	12	4	33.3
Montana	38	3	7.9
Nevada	14	5	35.7
New Mexico	46	14	30.4
Utah	125	58	46.4
Wyoming	9	1	11.1
Pacific	3,748	1,237	33.0
Alaska	3	1	33.3
California	3,120	1,121	35.9
Hawaii	76	16	21.1
Oregon	148	23	15.5
Washington	401	76	19.0
Outlying areas	14	4	28.6

SOURCE: National Science Foundation

appendix c

reproduction of survey instruments

Page

Instructions for Survey of Graduate Science Students and Postdoctorals, Fall 1979 and Departmental Data Sheet, Form 812 57

Survey of Earned Doctorates Awarded in the United States 61

INSTRUCTIONS FOR SURVEY OF GRADUATE SCIENCE STUDENTS AND POSTDOCTORALS, FALL 1979

General Definitions

A *graduate student* is defined as a student enrolled for credit in an advanced-degree program leading to either a master's or Ph.D. degree in fall 1979. M.D., D.V.M., or D.D.S. candidates, interns, and residents should *not* be reported *unless* they are concurrently working for a master's or Ph.D. in a science or engineering field or are enrolled in a joint M.D./Ph.D program. Individuals who already hold an M.D., D.V.M., or D.D.S., master's or Ph.D. degree but who are working on *another* master's or Ph.D. degree are to be counted as graduate students, either full or part time. *Do not* report such individuals as postdoctorals in item 8.

Graduate students performing thesis or dissertation research away from the campus at Government and contractor-owned facilities in the United States are to be included as long as they are enrolled for credit in an advanced-degree program. Students enrolled at a branch or extension center in a foreign country are to be *excluded*.

A graduate student, whether full- or part-time, should be reported in only one department. If any students are in interdisciplinary programs, please be sure that they are counted only once by their "home" department. If a graduate student is enrolled in an inter-institutional program, please report the student only if the degree will be granted by your institution. Please report in terms of headcounts, *not* in full-time-equivalent (FTE) terms.

Item Instructions and Definitions

Highest degree offered, item 4: Check the item which refers to the *highest* degree program offered by this science department in fall 1979. If your department does not offer a graduate degree, but is a department of clinical medicine with or without postdoctorals, check (3).

Full-time graduate students, item 5: A full-time graduate student is defined as a student enrolled for credit in an advanced-degree program (not a regular staff member or a postdoctoral) who is engaged full time in training activities in his/her field of science; these activities may embrace any appropriate combination of study, teaching, and research, depending on *your institution's own policy*. If your department has no full-time graduate students, write "None" in item 5 and move to item 6.

Mechanisms of support, item 5, lines 1-5: Report each full-time graduate student according to the *type of major support* received in the fall of 1979. Students who receive *fellowships or traineeships* should be reported on lines 1 and 2, respectively, if either of these mechanisms constitute the major source of his/her support. The Federal Interagency Committee on Education (FICE) differentiates between the two *fellowship and traineeship* stipends as follows: (1) A fellowship is an award made directly to or on behalf of a student selected in a national competition, to enable him to pursue post-baccalaureate training, and (2) a traineeship is an educational award to a student selected by his university. Except for the student selection process, the terms and conditions of the two types of awards are generally identical. A student receiving primary support from an assistantship should be classified as a research assistant on line 3 or as a teaching assistant on line 4, depending on how he/she spends the majority of his/her time, e.g., a graduate assistant devoting most of his/her time to teaching should be classified as a graduate teaching assistant. All other full-time graduate students should be reported on line 5.

Students receiving financial assistance, item 5, columns (A) thru (H): Report the number of full-time graduate students in the appropriate column according to the source of the largest portion of their support. In determining the source of major support, consider only tuition and other academic expenses. If a graduate student receives stipend support from more than one source, choose the *major* category of support.

Federal sources, columns (A) thru (E): Report the number of full-time graduate students in the appropriate column where they receive the largest portion of their support. Full-time graduate students receiving the largest portion of their support, from Federal Government *loans* should be reported as *self-supported*, column (I).

Department of Defense (DOD), column (A): Report full-time graduate students receiving support from the Department of the Army, Navy, or Air Force. Students receiving their *major* support from the Veterans Administration under the G.I. Bill should be reported under column (E), "Other Federal Sources;" if this form of support does not constitute his/her *major* source, the student should be counted in the appropriate column representing that source.

Department of Health, Education, and Welfare (HEW), columns (B) and (C): Report full-time graduate students receiving support from the institutes or divisions of the

National Institute of Health (NIH) under the column (B); support from all other components of HEW should be reported under column (C), as indicated below:

National Institutes of Health (report in column B):
- Division of Research Resources
- Fogarty International Center
- National Cancer Institute
- National Eye Institute
- National Heart, Lung, and Blood Institute
- National Institute on Aging
- National Institute of Allergy and Infectious Diseases
- National Institute of Arthritis, Metabolism, and Digestive Diseases
- National Institute of Child Health and Human Development
- National Institute of Dental Research
- National Institute of Environmental Health Sciences
- National Institute of General Medical Sciences
- National Institute of Neurological and Communicative Disorders and Stroke

NSF Form 812, Oct. 79

NATIONAL SCIENCE FOUNDATION and NATIONAL INSTITUTES OF HEALTH
SURVEY OF GRADUATE SCIENCE STUDENTS AND POSTDOCTORALS, FALL 1979

Form Approved
FEDAC No. R0093
App. Exp. 12/81

DEPARTMENTAL DATA SHEET

(NOTE: BEFORE FILLING OUT PLEASE READ THE ATTACHED INSTRUCTIONS.)

1. Name and address of institution: _____

2. Science or engineering department (or unit) covered by this data sheet: _____

3. Person in department (or unit) preparing this form:
   Name: _____
   Title: _____ Phone: ( )

4. Highest degree offered by department in fall 1979 (CHECK ONE ONLY) Master's _____(1) Doctorate _____(2) No graduate degree offered _____(3)

Institution and department code
(Leave blank)

NOTE: IF YOUR DEPARTMENT DOES NOT ENROLL GRADUATE STUDENTS, PLEASE MOVE TO ITEM 8 BELOW.

5. Number of FULL-TIME GRADUATE STUDENTS enrolled for advanced degrees (master's and doctorate) in fall 1979

MECHANISMS OF SUPPORT		STUDENTS RECEIVING FINANCIAL ASSISTANCE: FEDERAL SOURCES (excluding loans)					STUDENTS RECEIVING FINANCIAL ASSISTANCE: NON-FEDERAL SOURCES			SELF-SUPPORTED STUDENTS (Including loans and family sources)	TOTAL FOR ALL SOURCES (Sum of (A) thru (I))
		Department of Defense	DHEW: National Institutes of Health	DHEW: Other DHEW	National Science Foundation	Other Federal sources	Institutional support 1/	Foreign sources	Other U.S. sources 2/		
		(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)
Graduate Fellowships	(1)										
Graduate Traineeships	(2)										
Graduate Research Assistantships	(3)										
Graduate Teaching Assistantships	(4)										
Other Types of Support	(5)										
FULL-TIME TOTAL	(6)										
For each total on line (6) how many are WOMEN?	(7)										

FOREIGN STUDENTS	(8)	Of the full-time graduate students on line (6), column (J), how many are FOREIGN students?	
FIRST-YEAR STUDENTS	(9)	Of the full-time graduate students on line (6), column (J), how many are FIRST-YEAR students?	

1/ Include support from this university and State and local governments.

2/ Include support from nonprofit institutions, industry, and all other U.S. sources.

6. NUMBER OF PART-TIME GRADUATE STUDENTS		
PART-TIME TOTAL	(1)	
Of the part-time total on line (1), how many are WOMEN?	(2)	
Of the part-time total on line (1), how many are FIRST YEAR?	(3)	

Check List

- ☐ 1. Do all entries reflect headcounts and **NOT** FTE's?
- ☐ 2. Do the data in items 5, 7, and 8 add to totals?
- ☐ 3. Have you **included** all self-supported full-time students in item 5, column I?
- ☐ 4. Have you **excluded** M.D., D.D.S., and D.V.M. candidates, interns, and residents (except those enrolled in joint programs with the Ph. D.) from items 5 and 6?

ITEM 7 IS OPTIONAL IN 1979

		U.S. CITIZENS						
	Of the graduate student totals in items 5 and 6, how many belong to the following racial/ethnic categories?	Black non-Hispanic (A)	Amer. Indian/ Alaskan Native (B)	Asian/ Pacific Islander (C)	Hispanic (D)	White non-Hispanic (E)	Foreign (F)	TOTAL (Sum of A thru F) (G)
7. RACIAL/ ETHNIC BACKGROUND	Full time (item 5, line 6, col. J)							
	Part time (item 6, line 1)							

8. Number of POSTDOCTORALS and NON-FACULTY DOCTORAL RESEARCH STAFF		POSTDOCTORALS						OTHER NON-FACULTY DOCTORAL RESEARCH STAFF
		SOURCE OF SUPPORT				TOTAL for all sources A thru D	Of the total in E, how many are FOREIGN?	
		Federal			Non-Federal			
		Fellowships (A)	Traineeships (B)	Research Grants (C)	(D)	(E)	(F)	(G)
TOTAL	(1)							
Of the total on line (1), how many are WOMEN?	(2)							

Please provide any comments which might explain variances from prior year's data:

Item 5: _____

Item 6: _____

Item 7: Are these data available at the department level? _____

Item 8: _____

NOTE: This information is solicited under the authority of the National Science Foundation Act of 1950, as amended. All information you provide will be used for statistical purposes only. Your response is entirely voluntary and your failure to provide some or all of the information will in no way adversely affect your institution.

Other HEW (report in column C):

Alcohol, Drug Abuse, and Mental Health Administration (including National Institute of Mental Health)
Center for Disease Control
Food and Drug Administration
Health Resources Administration
Health Services Administration
National Institute of Education
Office of Education
Social and Rehabilitation Service

Non-Federal sources, columns (F) thru (H):

Institutional support, column (F): Reports full-time graduate students receiving support from your own institution and State and local governments. Funds given to a university by the Federal Government, such as training grant funds, should be reported under the appropriate Federal agency and NOT reported as *institutional support*.

Foreign sources, column (G): Include support from any non-U.S. source.

Other U.S. sources, column (H): Include support from nonprofit institutions, private industry, and all other U.S. sources.

Self-supported students, column (I): Include full-time graduate students whose major source of support is derived from loans from any source and from personal or family financial contributions. Full-time graduate students receiving the largest portion of their support from Federal loans should be reported here.

Women, line 7: Report all women students by their source of major support. Please note that in each column, data on line 7 should not exceed the total on line 6.

Foreign students, line 8: A *foreign* full-time graduate student is defined as an individual who has not attained U.S. citizenship. Do not include native residents of a U.S. possession, such as American Samoa. Applicants for U.S. citizenship are to be considered as *foreign* until the date their citizenship becomes effective.

First-year students, line 9: A first-year graduate student is defined as one who will have completed *less than a full year* of graduate study as of the beginning of the fall term in 1979 *in the program in which he/she is enrolled for a degree*. All other graduate students should be considered beyond their first year.

Part-time graduate students, item 6: A part-time graduate student is defined as a student who is enrolled in an advanced-degree program who is NOT pursuing graduate work full time as defined in item 5. Report the *total* number of part-time graduate students on line 1; if a department has no part-time graduate students, enter "None" and move to item 7.

Racial/ethnic background, item 7 (Optional in 1979): This item has been designated as optional for the fall 1979 survey year, in order to determine the availability of racial/ethnic data at the department level. We would appreciate your full cooperation in completing item 7 this year; however, if data are unavailable, please note this in the "Comments" section at the bottom of the form. Racial/ethnic designations as used in this survey do not denote scientific definitions of anthropological origins; a graduate student may thus be included in the group to which he/she appears to belong, identifies with, or is regarded in the community as belonging. However, no person should be counted in more than one racial/ethnic group. The following racial/ethnic designations are those defined by the Office of Civil Rights:

U.S. CITIZENS:

Black, non-Hispanic, column (A): Report persons having origins in any of the black racial groups (except those of Hispanic origin).

American Indian or Alaskan Native, column (B): Report persons having origins in any of the original peoples of North America.

Asian or Pacific Islander, column (C): Report persons having origins in any of the original peoples of the Far East, Southeast Asia, or the Pacific Islands. These areas include China, Japan, Korea, the Philippine Islands, and Samoa.

Hispanic, column (D): Report persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race.

White, non-Hispanic, column (E): Report persons having origins in any of the original peoples of Europe, North Africa, the Middle East or the Indian subcontinent, except those of Hispanic origin.

In column (F) report the number of foreign students as defined earlier.

On line 1 report the total number of full-time graduate students under the appropriate racial/ethnic category. Item 7, line 1, column (G) should equal the full-time total reported in item 5, line 6, column (J). Similarly, the total number of part-time graduate students should be reported on line 2. Item 7, line 2, column (G), should equal the part-time total reported in item 6, line 1.

Postdoctorals and nonfaculty doctoral research staff, item 8: Under this category, include individuals with science or engineering Ph.D.'s, M.D.'s, D.D.S.'s, or D.V.M.'s (including foreign degrees that are equivalent to U.S. doctorates) who devote *full time to research* activities or study in the department under temporary appointments carrying no academic rank. Such appointments are generally for a *specific time period*. They may contribute to the academic program through seminars, lectures, or working with graduate students. Their postdoctoral activities provide additional training for them. Exclude appointments in residency training programs in medical and health professions, unless *research training* under the supervision of a *senior mentor* is the *primary purpose* of the appointment. On line 1, under columns (A) and (B), enter the number of fellows and trainees receiving support under Federal fellowships and/or training grants. Under column (C) enter the number of postdoctorals who are receiving federally supported research grants. Those remaining postdoctoral appointees receving non-Government support should be entered under column (D). Of the *total* in column (E), enter the column (F) the number of postdoctorals with *foreign* citizenship. Under *other nonfaculty doctoral research staff*, column (G), report all doctoral scientists and engineers who are principally involved in research activities but who are considered *neither* postdoctoral appointees nor members of the *regular* faculty. On line 2, report the number of women in each category; please note that in each column, data on line 2 should not exceed the total on line 1.

Conducted by
The National Research Council
in Cooperation with
The American Council of Learned Societies,
The Social Science Research Council, and
The Graduate Deans

Supported by
The National Science Foundation,
The U.S. Office of Education,
The National Endowment for the Humanities, and
The National Institutes of Health

To the Doctoral Candidate:

This is a brief description of the Survey of Earned Doctorates indicating how the resulting data are used and the individual confidentiality of data is protected. The basic purpose of this Survey is to gather objective data about doctoral graduates, data that are often helpful in improving graduate education. We ask your cooperation with the project.

The information requested on the accompanying questionnaire is largely self-explanatory. Please complete it, detach it along the perforated line, and return it to your Graduate Dean. On the back of this sheet is a Specialties List with code numbers and titles for classifying your fields of specialization. This will be useful in connection with several items on the questionnaire. If none of the detailed fields listed seems to be appropriate, note the "General" and "Other" categories.

What is the Survey of Earned Doctorates?

The Survey is conducted annually by the Commission on Human Resources of the National Research Council in cooperation with the American Council of Learned Societies and the Social Science Research Council. The form is distributed with the cooperation of the Graduate Deans and filled out by all graduates who have completed requirements for their doctoral degrees. Research doctorates in all fields are included, but professional degrees such as the MD, DDS, and DVM are not included because information about recipients of those degrees is compiled elsewhere. The cumulative file goes back to 1920 and is called the Doctorate Records File.

The use of the doctoral data has been increasing, partly because of the implications for graduate education stemming from the change in the growth pattern of the number of persons receiving doctorates (562 in 1920; 3,278 in 1940; 9,735 in 1960; 29,497 in 1970; peaking at 33,727 in 1973; and now at 32,923 in 1976). This survey attempts to supply some of the information as of the time the doctorate is received.

What uses are made of the Survey data?

The data collected by this survey questionnaire become part of the Doctorate Records File maintained by the Commission on Human Resources of the National Research Council. The Survey data are collected with the intention that they will be put to use, but only under carefully defined conditions. Such data as the number of degrees awarded in each field of specialization, the educational preparation of degree recipients, their sources of financial support, the length of time required to attain the degree, and postdoctoral employment plans of doctorate recipients are of great interest to graduate schools, employers, the scholarly community, and the nation generally. The Doctorate Records File is used for a limited number of carefully defined, follow-up research studies. Each year a sample of doctorate recipients is selected for inclusion in a longitudinal research file maintained for the National Science Foundation, the National Institutes of Health, and the National Endowment for the Humanities.

Statistical summaries from the Doctorate Records File are used by educational institutions, professional societies, and government agencies. Some specific examples are:

- An extensive statistical summary of the data is published and distributed to all graduate schools about every five years.(1) These reports have been widely used by graduate schools and states to evaluate their progress in providing doctoral education. The data may also be useful to graduate students as an aid in selecting a graduate department.
- Annual reports containing statistical summaries based on the most recent year's Survey are distributed to graduate schools, government agencies, and many others on request.(2)

The confidentiality of Survey data is carefully protected.

This information is solicited under the authority of the National Science Foundation Act of 1950, as amended. All information you provide will be treated as confidential and will be used for statistical purposes only. Information will be released only in the form of statistical summaries or in a form which does not identify information about any particular person. There are only two exceptions to this policy: (1) information (name, year, and field of degree) is released to institutions from which you received degrees and to other organizations as part of the address search procedure for follow-up research studies: and (2) information from your form will be made available to the institution where you receive your doctoral degree. This latter release of information is contingent upon receipt of a signed statement from the institution that the information will be used only for internal purposes. Your response is entirely voluntary and your failure to provide some or all of the information will in no way adversely affect you.

(1) National Academy of Sciences, *Doctorate Recipients from United States Universities, 1958-1966,* Washington, D. C. 1967.
(2) National Academy of Sciences, *Summary Report 1976, Doctorate Recipients from United States Universities,* Washington, D. C. March, 1977.

NSF Form 558 1977
OMB No. 99-R0290
Approval Expires June 30, 1979

SURVEY OF EARNED DOCTORATES

This form is to be returned to the GRADUATE DEAN, for forwarding to ..... Board on Human-Resource Data and Analyses
Commission on Human Resources
National Research Council
2101 Constitution Avenue, Washington, D. C. 20418

Please print or type.

A. Name in full: ..... (9-30)
(Last Name) (First Name) (Middle Name)

Cross Reference: Maiden name or former name legally changed ..... (31)

B. Permanent address through which you could always be reached: (Care of, if applicable) .....
.....
(Number) (Street) (City)
.....
(State) (Zip Code) (Or Country if not U.S.)

C. U.S. Social Security Number: ___ ___ ___ - ___ ___ - ___ ___ ___ ___ (32-40)

D. Date of birth: ..... Place of birth: .....
(41-45) (Month) (Day) (Year) (46-47) (State) (Or Country if not U.S.)

E. Sex: 1 ☐ Male 2 ☐ Female (48)

F. Marital status: 1 ☐ Married 2 ☐ Not married (including widowed, divorced) (49)

G. Citizenship: 0 ☐ U.S. native 2 ☐ Non U.S., Immigrant (Permanent Resident)
1 ☐ U.S. naturalized 3 ☐ Non-U.S., Non-Immigrant (Temporary Resident) (50)
If Non-U.S., indicate country of present citizenship ..... (51-52)

H. Racial or ethnic group: (Check all that apply.) *A person having origins in —*
0 ☐ American Indian or Alaskan Native ..... any of the original peoples of North America, and who maintain cultural identification through tribal affiliation or community recognition.
1 ☐ Asian or Pacific Islander ..... any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands. This area includes, for example, China, Japan, Korea, the Philippine Islands, and Samoa.
2 ☐ Black, not of Hispanic Origin ..... any of the black racial groups of Africa.
3 ☐ White, not of Hispanic Origin ..... any of the original peoples of Europe, North Africa, or the Middle East.
4 ☐ Hispanic ..... Mexican, Puerto Rican, Central or South American, or other Spanish culture or origins, regardless of race. (53-55)

I. Number of dependents: Do not include yourself. (Dependent = someone receiving at least one half of his or her support from you) ..... (56)

J. U.S. veteran status: 0 ☐ Veteran 1 ☐ On active duty 2 ☐ Non-veteran or not applicable (57)

K. High school last attended: ..... (58-59)
(School Name) (City) (State)
Year of graduation from high school: ..... (60-61)

L. List in the table below all collegiate and graduate institutions you have attended including 2-year colleges. List chronologically, and include your doctoral institution as the last entry.

Institution Name	Location	Years Attended		Major Field		Minor Field	Degree (if any)		
		From	To	Use Specialties List Name	Number	Number	Title of Degree	Granted Mo.	Yr.

M. Enter below the title of your doctoral dissertation and the most appropriate classification number and field. If a project report or a musical or literary composition (not a dissertation) is a degree requirement, please check box. ☐ (44)

Title .....
.....
.....

Classify using Specialties List
Number Name of field
....

N. Name the department (or interdisciplinary committee, center, institute, etc.) and school or college of the university which supervised your doctoral program: .....
(Department/Institute/Committee/Program) (School)

O. Name of your dissertation adviser: .....
(Last Name) (First Name) (Middle Initial)

62

continued on next page

P. Please enter a "1" beside your primary source of support during graduate study. Enter a "2" beside your secondary source of support during graduate study. Check all other sources from which support was received.

58 ___ NSF Fellowship
59 ___ NSF Traineeship
60 ___ NIH Fellowship
61 ___ NIH Traineeship
62 ___ NDEA Fellowship
63 ___ Other HEW
64 ___ AEC/ERDA Fellowship
65 ___ NASA Traineeship
66 ___ GI Bill
67 ___ Other Federal support (specify) .....
68 ___ Woodrow Wilson Fellowship
69 ___ Other U.S. national fellowship (specify) .....
70 ___ University Fellowship
71 ___ Teaching Assistantship
72 ___ Research Assistantship
73 ___ Educational fund of industrial or business firm
74 ___ Other institutional funds (specify) .....
75 ___ Own earnings
76 ___ Spouse's earnings
77 ___ Family contributions
78 ___ Loans (NDSL direct)
79 ___ Other loans
80 ___ Other (specify) .....

Q. Please check the space which most fully describes your status during the year immediately preceding the doctorate.

0 ☐ Held fellowship
1 ☐ Held assistantship
2 ☐ Held own research grant
3 ☐ Not employed
4 ☐ Part-time employed

Full-time Employed in: (Other than 0, 1, 2)
5 ☐ College or university, teaching
6 ☐ College or university, non-teaching
7 ☐ Elem. or sec. school, teaching
8 ☐ Elem. or sec. school, non-teaching
9 ☐ Industry or business
(11) ☐ Other (specify) .....
(12) ☐ Any other (specify) ..... [9]

R. How many years (full-time equivalent basis) of professional work experience did you have prior to the doctorate? (include assistantships as professional experience) .....(10-11)

S. How well defined are your postgraduation plans?
0 ☐ Have signed contract or made definite commitment
1 ☐ Am negotiating with a specific organization, or more than one
2 ☐ Am seeking appointment but have no specific prospects
3 ☐ Other (specify) .....(12)

T. What are your immediate postgraduation plans?
0 ☐ Postdoctoral fellowship?
1 ☐ Postdoctoral research associateship?
2 ☐ Traineeship?
3 ☐ Other study (specify) ..... } Go to Item "U"
4 ☐ Employment (other than 0, 1, 2, 3)
5 ☐ Military service?
6 ☐ Other (specify).....(13) } Go to Item "V"

U. If you plan to be on a postdoctoral fellowship, associateship, traineeship or other study

What will be the field of your postdoctoral study?
Classify using Specialties List.
Number Field
....(14-16)

What will be the primary source of support?
0 ☐ U.S. Government
1 ☐ College or university
2 ☐ Private foundation
3 ☐ Nonprofit, other than private foundation
4 ☐ Other (specify) .....(17)
6 ☐ Unknown

Go to Item "W"

V. If you plan to be employed, enter military service, or other — What will be the type of employer?
0 ☐ 4-year college or university other than medical school
1 ☐ Medical school
2 ☐ Jr. or community college
3 ☐ Elem. or sec. school
4 ☐ Foreign government
5 ☐ U.S. Federal government
6 ☐ U.S. state government
7 ☐ U.S. local government
8 ☐ Nonprofit organization
9 ☐ Industry or business
(11) ☐ Self-employed
(12) ☐ Other (specify) .....(18)

Indicate *primary* work activity with "1" in appropriate box; *secondary* work activity (if any) with "2" in appropriate box.
0 ☐ Research and development
1 ☐ Teaching
2 ☐ Administration
3 ☐ Professional services to individuals
5 ☐ Other (specify).....(19-20)

In what field will you be working?
Please enter number from Specialties List .....(21-23)

Go to Item "W"

W. What is the name and address of the organization with which you will be associated?

....
(Name of Organization)

.... (24-29)
(Street) (City, State) (Or Country if not U.S.)

X. Please indicate, by circling the highest grade attained, the education of

		Elementary school							High school				College				Graduate			Postdoctoral	
your father:	none	1	2	3	4	5	6	7 8	9	10	11	12	1	2	3	4	MA, MD	PhD			(30)
your mother	none	1	2	3	4	5	6	7 8	9	10	11	12	1	2	3	4	MA, MD	PhD			(31)
	0	1			2			3	4			5	6			7	8	9		(11)	

Signature ..... Date completed .....
(32-34)

63

MATHEMATICS

000 Algebra
010 Analysis & Functional Analysis
020 Geometry
030 Logic
040 Number Theory
050 Probability & Math. Statistics (see also 544, 670, 725, 727, 920)
060 Topology
080 Computing Theory & Practice
082 Operations Research (see also 478)
085 Applied Mathematics
098 Mathematics, General
099 Mathematics, Other*

COMPUTER SCIENCES

079 Computer Sciences* (see also 437)

ASTRONOMY

101 Astonomy
102 Astrophysics

PHYSICS

110 Atomic & Molecular
120 Electromagnetism
132 Acoustics
134 Fluids
135 Plasma
136 Optics
138 Thermal
140 Elementary Particles
150 Nuclear Structure
160 Solid State
198 Physics, General
199 Physics, Other*

CHEMISTRY

200 Analytical
210 Inorganic
220 Organic
230 Nuclear
240 Physical
250 Theoretical
260 Agricultural & Food
270 Pharmaceutical
275 Polymer
298 Chemistry, General
299 Chemistry, Other*

EARTH, ENVIRONMENTAL AND MARINE SCIENCES

301 Mineralogy, Petrology
305 Geochemistry
310 Stratigraphy, Sedimentation
320 Paleontology
330 Structural Geology
341 Geophysics (Solid Earth)
350 Geomorph. & Glacial Geology
391 Applied Geol., Geol. Engr. & Econ. Geol.
395 Fuel Tech. & Petrol. Engr. (see also 479)
360 Hydrology & Water Resources
370 Oceanography
397 Marine Sciences, Other*
381 Atmospheric Physics and Chemistry
382 Atmospheric Dynamics
383 Atmospheric Sciences, Other*
388 Environmental Sciences, General (see also 480, 528)
389 Environmental Sciences, Other*
398 Earth Sciences, General
399 Earth Sciences, Other*

ENGINEERING

400 Aeronautical & Astronautical
410 Agricultural
415 Biomedical
420 Civil
430 Chemical
435 Ceramic
437 Computer
440 Electrical
445 Electronics
450 Industrial
455 Nuclear
460 Engineering Mechanics
465 Engineering Physics
470 Mechanical
475 Metallurgy & Phys. Met. Engr.
476 Systems Design & Systems Science
478 Operations Research (see also 082)
479 Fuel Tech. & Petrol. Engr. (see also 395)
480 Sanitary & Environmental
486 Mining
497 Materials Science
498 Engineering, General
499 Engineering, Other*

AGRICULTURAL SCIENCES

500 Agronomy
501 Agricultural Economics
502 Animal Husbandry
503 Food Science & Technology
504 Fish & Wildlife
505 Forestry
506 Horticulture
507 Soils & Soil Science
510 Animal Science & Animal Nutrition
511 Phytopathology
518 Agriculture, General
519 Agriculture, Other*

MEDICAL SCIENCES

522 Public Health & Epidemiology
523 Veterinary Medicine
526 Nursing
527 Parasitology
528 Environmental Health
534 Pathology
536 Pharmacology
537 Pharmacy
538 Medical Sciences, General
539 Medical Sciences, Other*

BIOLOGICAL SCIENCES

540 Biochemistry
542 Biophysics
544 Biometrics & Biostatistics (see also 050, 670, 725, 727, 920)
545 Anatomy
546 Cytology
547 Embryology
548 Immunology
550 Botany
560 Ecology
562 Hydrobiology
564 Microbiology & Bacteriology
566 Physiology, Animal
567 Physiology, Plant
569 Zoology
570 Genetics
571 Entomology
572 Molecular Biology
576 Nutrition and/or Dietetics
578 Biological Sciences, General
579 Biological Sciences, Other*

PSYCHOLOGY

600 Clinical
610 Counseling & Guidance
620 Developmental & Gerontological
630 Educational
635 School Psychology
641 Experimental
642 Comparative
643 Physiological
650 Industrial & Personnel
660 Personality
670 Psychometrics (see also 050, 544, 725, 727, 920)
680 Social
698 Psychology, General
699 Psychology, Other*

SOCIAL SCIENCES

700 Anthropology
708 Communications*
710 Sociology
720 Economics (see also 501)
725 Econometrics (see also 050, 544, 670, 727, 920)
727 Statistics (see also 050, 544, 670, 725, 920)
740 Geography
745 Area Studies*
751 Political Science
752 Public Administration
755 International Relations
770 Urban & Reg. Planning
798 Social Sciences, General
799 Social Sciences, Other*

HUMANITIES

802 History & Criticism of Art
804 History, American
805 History, European
806 History, Other*
807 History & Philosophy of Science
808 American Studies
809 Theatre and Theatre Criticism
830 Music
831 Speech as a Dramatic Art (see also 885)
832 Archeology
833 Religion (see also 881)
834 Philosophy
835 Linguistics
836 Comparative Literature
878 Humanities, General
879 Humanities, Other*

LANGUAGES & LITERATURE

811 American
812 English
821 German
822 Russian
823 French
824 Spanish & Portuguese
826 Italian
827 Classical*
829 Other Languages*

EDUCATION

900 Foundations: Social & Philosoph.
910 Educational Psychology
908 Elementary Educ., General
909 Secondary Educ., General
918 Higher Education
919 Adult Educ. & Extension Educ.
920 Educ. Meas. & Stat.
929 Curriculum & Instruction
930 Educ. Admin. & Superv.
940 Guid., Couns., & Student Pers.
950 Special Education (Gifted, Handicapped, etc.)
960 Audio-Visual Media

TEACHING FIELDS

970 Agriculture Educ.
972 Art Educ.
974 Business Educ.
976 English Educ.
978 Foreign Languages Educ.
980 Home Economics Educ.
982 Industrial Arts Educ.
984 Mathematics Educ.
986 Music Educ.
988 Phys. Ed., Health, & Recreation
989 Reading Education
990 Science Educ.
992 Social Science Educ.
993 Speech Education
994 Vocational Educ.
996 Other Teaching Fields*

998 Education, General
999 Education, Other*

OTHER PROFESSIONAL FIELDS

881 Theology (see also 833)
882 Business Administration
883 Home Economics
884 Journalism
885 Speech & Hearing Sciences (see also 831)
886 Law & Jurisprudence
887 Social Work
891 Library & Archival Science
897 Professional Field, Other*

899 OTHER FIELDS*

* Identify the specific field in the space provided on the questionnaire.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1981 — O-- 358-401/7180

other science resources publications

	NSF No.	Price
Science Resources Studies Highlights		
R&D Funds		
"Real Growth in Industrial R&D Performance Continues into 1979"	81-313	—
"March Budget Revisions Raised Defense R&D Support in 1982—Cut All Other Areas"	81-321	—
"Federal R&D Obligations Will Show Real Growth in 1981—Mostly From DOD Programs"	80-322	—
S/E Personnel		
"Trends in Science and Engineering Degrees, 1950 Through 1980"	81-320	—
"Engineering Colleges Report 10% of Faculty Positions Vacant in Fall 1980/81"	81-322	—
"Number of Recent Doctorates Fell to One-Fifth of Science and Engineering Faculty in 1980"	81-318	—
"University S/E Faculty Spend One-Third of Professional Time in Research"	81-317	—
"Employment Opportunities for Ph.D. Scientists and Engineers Shift from Academia to Industry"	81-312	—
Composite		
"National R&D Spending Expected to Approach $80 Billion in 1982"	81-314	—
Detailed Statistical Tables		
R&D Funds		
Federal Funds for Research and Development, Fiscal Years 1979, 1980, and 1981, Volume XXIX	80-318	—
Research and Development in Industry, 1978. Funds, 1978; Scientists and Engineers, January 1979	80-307	—
S/E Personnel		
Federal Scientific and Technical Personnel: 1976, 1977, and 1978	81-309	—
Employment of Scientists, Engineers, and Technicians in Manufacturing Industries, 1977	80-306	—
U.S. Scientists and Engineers, 1978	80-304	—
Characteristics of Doctoral Scientists and Engineers in the United States	80-323	—
Reports		
Federal Funds for Research and Development, Fiscal Years 1979, 1980, and 1981, Volume XXIX	81-306	—
S/E Personnel		
Young and Senior Science and Engineering Faculty, 1980	81-319	In press
Activities of Science and Engineering Faculty in 4-Year Colleges and Universities, 1978-79	81-323	In press
Science and Engineering Employment: 1970-80	81-310	In press
The Stock of Science and Engineering Master's Degree Holders in the United States	81-302	—
Employment Attributes of Recent Science and Engineering Graduates	80-325	$1.75
Scientists, Engineers, and Technicians in Private Industry, 1978-80	80-320	$2.00
Occupational Mobility of Scientists and Engineers	80-317	$1.75
Composite		
National Patterns of Science and Technology Resources, 1981	81-311	$4.75
Science and Engineering Personnel: A National Overview	80-316	$4.75